ELECTRICAL TIMES

THURSDAY
12 NOV. 1953
NINEPENCE

BICC **WIRING SYSTEM CABLES**

Each BICC cable has its own special application, and, used with the appropriate BICC fittings, provides the most effective wiring system for all conditions in factories, offices, homes and farms.

Write to-day for further information contained in these Publications: No. 236 (Farm Wiring System); No. 323 (Industrial Wiring System) and No. 333 (Wiring Systems).

BRITISH INSULATED CALLENDER'S CABLES LIMITED
21 BLOOMSBURY STREET, LONDON, W.C.1

Only **£3·17·6**

INCLUDING P.T.

This smart little fire is really attractive and is proving a big seller. Order your stocks now and be in on a good thing.

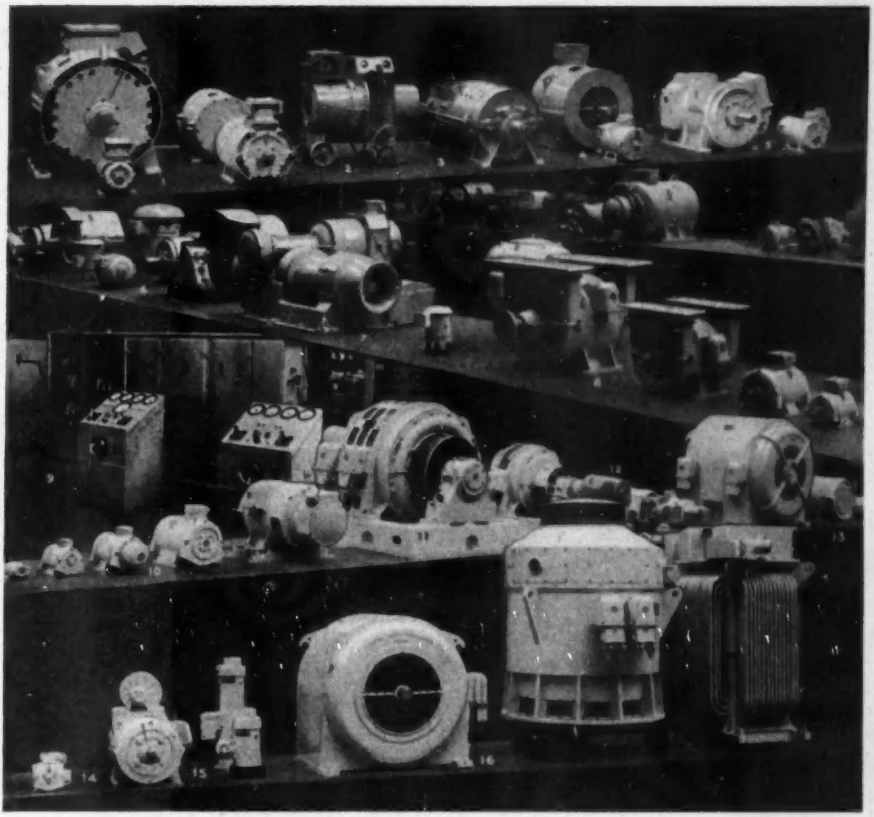
Model F.104

Loading: 1 kW.
Dimensions: 11¼" high, 16⅜" wide, 7½" deep

BRITISH NATIONAL ELECTRICS LTD

The domestic appliance section of JOHNSON & PHILLIPS LTD.

NEWARTHILL · MOTHERWELL · SCOTLAND



1-5—Special purpose a.c. and d.c. motors: flameproof, crane, mill, etc. 6-8—Marine type motors and winches. 9-13—Standard industrial a.c. motors, etc. 14-16—N-S variable speed a.c. motors.

A very wide range of very good motors, and allied equipment, is made by L.S.E.

LAURENCE, SCOTT & ELECTROMOTORS LTD.

Specialist Makers of Electric Motors since 1883

L.S.E.

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The Automatic Choice

The Morrison Franchise is the Automatic Choice of enterprising Distributing Houses seeking lucrative business in a widening market for Automatic Electric Generating Plants. Morrison liberal terms are backed by strong sales support and a service second to none.

MORRISON AUTOMATIC

ELECTRIC GENERATING PLANTS

250 watts to 46 kVA. All Voltages. For diesel, kerosene or gasoline fuels.
A. C. MORRISON (ENGINEERS) LTD., LOUGHBOROUGH, ENG.
Makers of Electric Generating Plants for Farm, Home, Shop, Factory, Marine and Service use.
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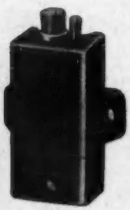
PROTECT

your motors, refrigerators, washing machines, battery chargers, transformers, and all your electrical and electronic equipment with

E-T-A



Thermally Operated Miniature Circuit Breakers (single pole and three pole) Rated current from ·05 Amp. up to 25 Amps. Exceptionally small dimensions. Easy incorporation or mounting.

Also ELPRO **Automatic Miniature Circuit Breakers** for lighting and power.

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THE STEEL COVERED HEATER UNIT

WITH **101**

USES

IN its variety of forms, the Cressall steel jacketed unit heater is the solution to most heating problems. Let a Cressall Technical Expert discuss heating with you before you decide. He will be happy to help.

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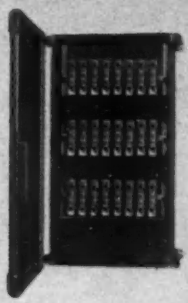
Registered Trade Name of
THE CRESSALL MANUFACTURING CO LTD
Tower Street, Birmingham 19
Telephone: ASTon Cross 2666 (3 lines)
Telegrams: "OHMIC, Birmingham"

You cannot buy better gear



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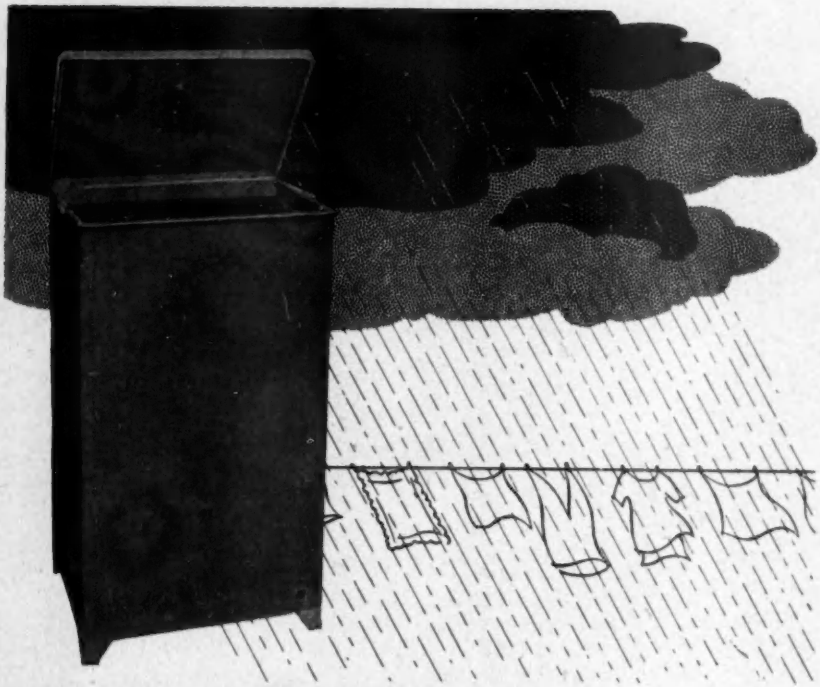
FUSES ARE FULLY INTERCHANGEABLE FOR
H.R.C. CARTRIDGES OR ARC DAMPING CARRIERS

15 AMPERE FUSES 250 VOLTS
20 " " 440 "
30-300 " " 440 "

SEND FOR LIST Nº F 653 AND F553

BILL SWITCHGEAR LTD.
ASTON LANE · PERRY BARR
BIRMINGHAM 20



whatever the weather . . . .

Yes, whatever the weather is like out of doors, the Belling Clothes Drying Cabinet soon dries the weekly wash—indoors. You won't have to spend long explaining to a housewife the advantages of that. Occupying a floor space only 21 inches wide and 14½ inches deep, the Belling Clothes Drying Cabinet quickly and thoroughly dries clothes for the whole family, at any hour of the day or night. Extremely popular with mothers of *very* young children! Nothing could be neater in appearance. Inside, warm air currents circulate, quickly removing all moisture from the clothes. The heating elements are fully guarded and the whole cabinet is quite rust and corrosion proof.

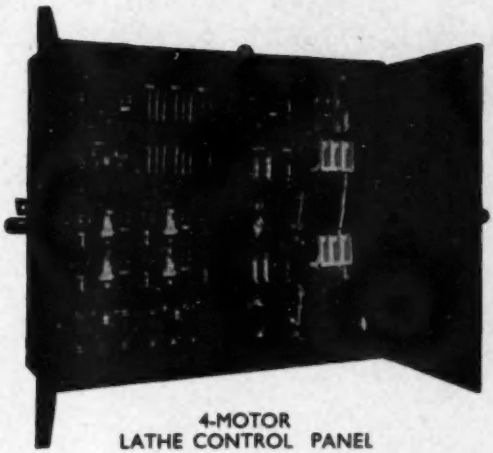
LIST No. 107A. Clothes Drying Cabinet £15.19.9 inc. tax. Consumption: 1,000 watts. Overall Size: 21″ wide x 36″ high x 14½″ deep. Construction and Finish: Sheet aluminium, finished in glossy white, cream or bronze enamel. The Cabinet opens at the top. Larger model, No. 108, 21″ wide x 72″ high x 14½″ deep, front opening. 3-heat control. 2 kW finished in white or cream £29.17.9 inc. tax.

You can't beat a "Belling"

BELLING & COMPANY LIMITED · BRIDGE WORKS · ENFIELD · MIDDLESEX · HOWARD 1212

CBC 404

IGRANIC ELECTRIC CONTROL GEAR



4-MOTOR
LATHE CONTROL PANEL

FAVOURABLE DELIVERY CAN NOW BE OFFERED FOR SPECIALLY BUILT CONTROL GEAR

FOR THE EFFICIENT PROTECTION OF VALUABLE MACHINERY AND FOR RELIABILITY SPECIFY:— IGRANIC CONTROL GEAR

SPECIALISED CONTROL EQUIPMENT FOR....

- AIR COMPRESSORS
- BLAST FURNACES
- CRANES AND TRANSPORTERS
- COAL HANDLING
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LIGHTING

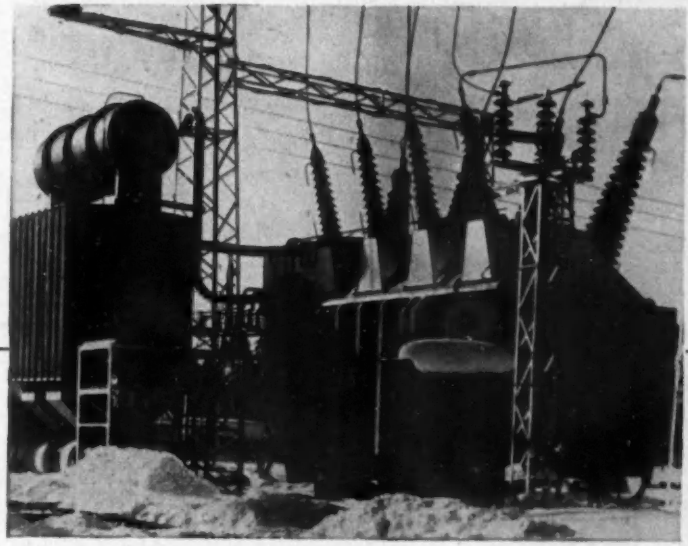
In Banks, as in all buildings in which sudden darkness can impose the risk of theft, emergency lighting is a necessary precaution. In bank buildings of the future the standby electrical system will be planned at the same time as the main lighting is planned. Chloride Batteries Ltd, makers of Keepalite, the automatic emergency lighting system, offer the advisory services of their engineers to architects and electrical contractors in any part of Britain.

Keepalite FOR BANKS

A Product of Chloride Batteries Limited, Exide Works, Clifton Junction, Swinton, Manchester and Grosvenor Gardens House, Grosvenor Gardens, SW1

S.71

220 kV transformers for Finland



The ENGLISH ELECTRIC Company is manufacturing two 64 MVA, 220 kV transformers for operation in Finland.
The illustration shows the first of these on its site at Petäjävesi.
The total weight of the transformers is 240 tons.
Their characteristics are: 64 MVA, three phase, 220/110 kV with fully insulated windings for arc-suppression coil protection, with an 11 kV tertiary winding supplying a synchronous condenser.

'ENGLISH ELECTRIC'
transformers

THE ENGLISH ELECTRIC COMPANY LTD., Queens House, Kingsway, London, W.C.2
Transformer Department, Stafford

WORKS: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL · ACCRINGTON
TH.5

See the English Electric advertisement for Electronic Insulation Tester which appears on page 73 of this issue

Send for Yours To-day . . .

Connollys have produced five handy "slide rule" tables which give, at a glance, considerable data not normally available in ready form, concerning winding wires as follows:

Enamel Normal	**"Oleo Resinous"**		**to B.S.S.**		**156/1951**	
Conymel F	**"Vinyl Acetal"**		**to B.S.S.**		**1844/1952**	
Conymel M	**"**	**"**	**"**	**"**	**"**	**"**
Conymel T	**"**	**"**	**"**	**"**	**"**	**"**
Conymel X	**"**	**"**	**"**	**"**	**"**	**"**

We shall be pleased to mail you one or more sets, if you will kindly write us on your business letterheading.

CONNOLLYS

The largest manufacturers of fine enamelled wires in the world

Winding Wires

CONNOLLYS (BLACKLEY) LIMITED

Kirkby Trading Estate, Near Liverpool

Telephone: SIMonswood 2664. Telegrams: "SYLLONOC, LIVERPOOL"

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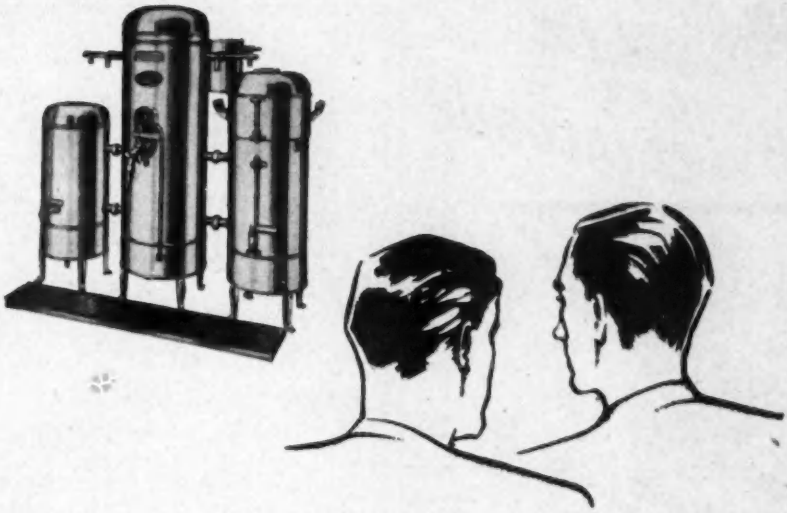

"It's never failed me yet"

"I can't tell you what a load the 'Jackson' takes off my shoulders—it is always efficient, always on top of the job. However busy we are, I know that here's one thing I haven't to worry about."

There's a 'Jackson' made for every catering need. 'Jackson' Boilers are supreme for all hotel and restaurant catering, cafes, milk bars, works canteens, hospitals and schools.

Jackson Boilers

Jackson Boilers Ltd. Vulcan Works, Shafton Lane, Leeds 11 Tel: 3-1088

Showrooms: 25 Victoria Street (entrance in Abbey Orchard St.), Westminster, S.W.1; 219 West George Street, Glasgow; 28 Deansgate Arcade, Manchester; 9 King Street, Leeds; 202 Corporation Street, Birmingham; 142 Victoria Street, Bristol.

Write or Phone for OUR 1953 CATALOGUE

48 pages illustrated of Electric Fires, Tubular Heaters, Kettles, Irons, Washing Machines, Refrigerators, Immersion Heaters and Circulators, Cookers, Clocks, Vacuum Cleaners and Floor Polishers, etc.

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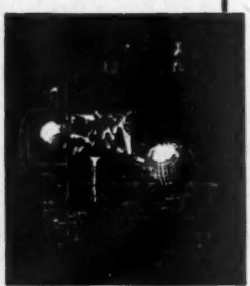
Trap your heat in BRADFORD STEAM TRAPS



Type B. DIRECT OPERATED DISCHARGE VALVE

Fuel is too expensive to waste. Every thermal unit must be converted into energy. Bradford Steam Traps ensure efficient use of steam and heat. Instantaneous opening and closing action prevents damage to valves and seats. There is a "Bradford" trap to suit all steam pressures. Every trap fully tested and guaranteed.

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STELLATE CORE IS THE

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... because it gives six points of rapid solder collapse and the flux is liberated *immediately* heat is applied. The correct amount of activated flux is always present in Superspeed, thus eliminating dry or H.R. joints. The stellate core is featured only in the Enthoven range of cored solders which ensures perfect soldering.

Superspeed

ACTIVATED ROSIN CORED SOLDER

for all Radio, T.V. electronic and telecommunication soldering. Complies with M.O.S. Specification DTD. 599 and is approved by the A.I.D., G.P.O. and R.C.S.C. Superspeed is available in a wide range of alloys and gauges. Samples together with comprehensive literature gladly sent on request. Technical advisers are available for consultation

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Renex Anti-corrosion Sheathing has been specially developed for application over the lead sheathing of Power and Auxiliary Cables to give protection against both chemical and electrolytic corrosion.

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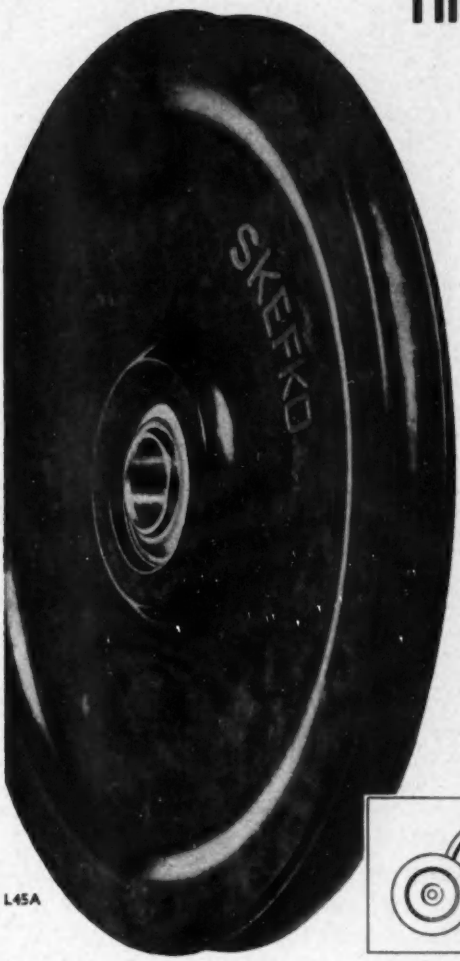
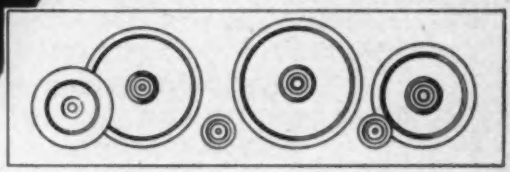
Associated Company: SCOTTISH CABLES (SOUTH AFRICA) LTD. PIETERMARITZBURG, NATAL

They're lively lads at Lorival...



L45A

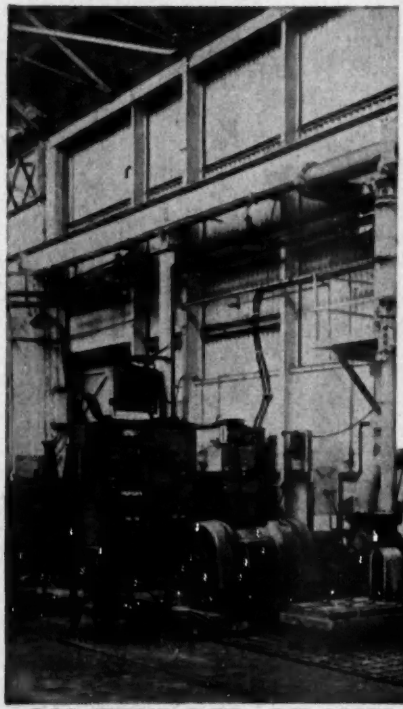
Skefko ball bearing control pulleys, standard equipment on service aircraft and civil airliners, are a good example of the saving of time and money by mass production of accurate, uniform plastics. For more than fourteen years, they have given reliable service in planes of every type. Made in fabric-filled phenolic material, they are strong, exact and concentric. The Skefko ball bearing is moulded in by a Lorival patent process. A full range to SBAC standards is manufactured.

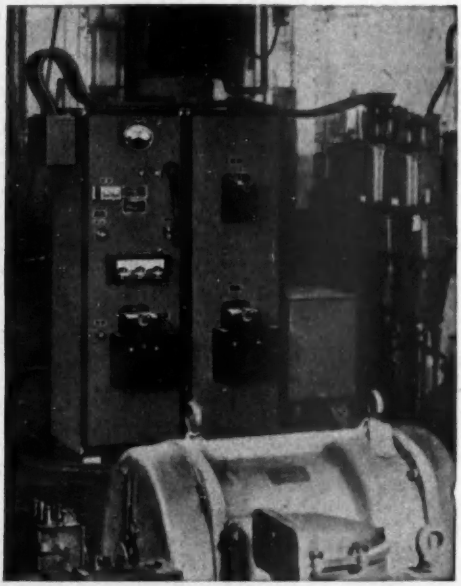


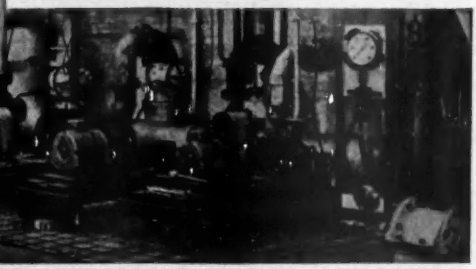
LORIVAL PLASTICS

UNITED EBONITE & LORIVAL LTD · LITTLE LEVER · NEAR BOLTON · LANCS

"Erskine Heap" SWITCHGEAR







ON TEST BED OF WELL-KNOWN PUMP MAKERS

This three oil switch type of Auto Transformer Starter with Korndorffer connections for testing the electrical side of their pumping plants, was recently manufactured for, and installed on the test bed of the well-known Pump Makers, Messrs. Hayward-Tyler & Co. Ltd., of Luton, Bedfordshire.

L.T. SWITCHGEAR: *50/5000 Amperes*
E.H.T. SWITCHGEAR *up to 11 kV 250 MVA rupturing capacity*
MOTOR CONTROL GEAR: *¼/5000 H.P.*

May we have your enquiries?

ERSKINE, HEAP & Co LTD

SWITCHGEAR SPECIALISTS

Head Office and Works
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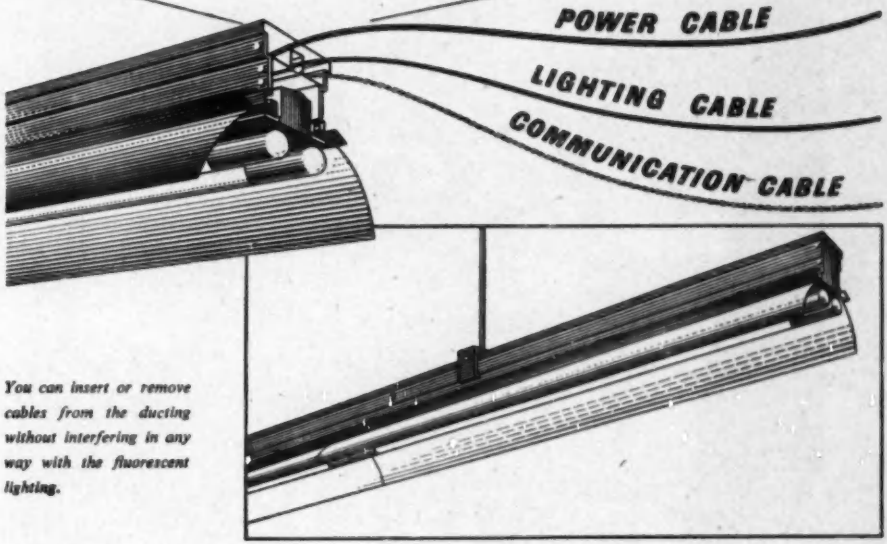
GRAND BUILDINGS, TRAFALGAR SQ., W.C.2.

BRANCH OFFICES AND AGENCIES IN ALL PARTS OF THE WORLD

656 (A)

ATLAS *Trunking*

also carries...



You can insert or remove cables from the ducting without interfering in any way with the fluorescent lighting.

Like all good ideas it is *so* simple. ATLAS trunking gives continuous fluorescent lighting on large or small spans and also provides a duct to carry the maze of wandering wires which so often occurs in factories or workshops. Access to ancillary cables is simple and easy. You will need ATLAS trunking sooner or later, so get full details *now*.

ATLAS FLUORESCENT

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Lighting Division
233 Shaftesbury Avenue, London, W.C.2.

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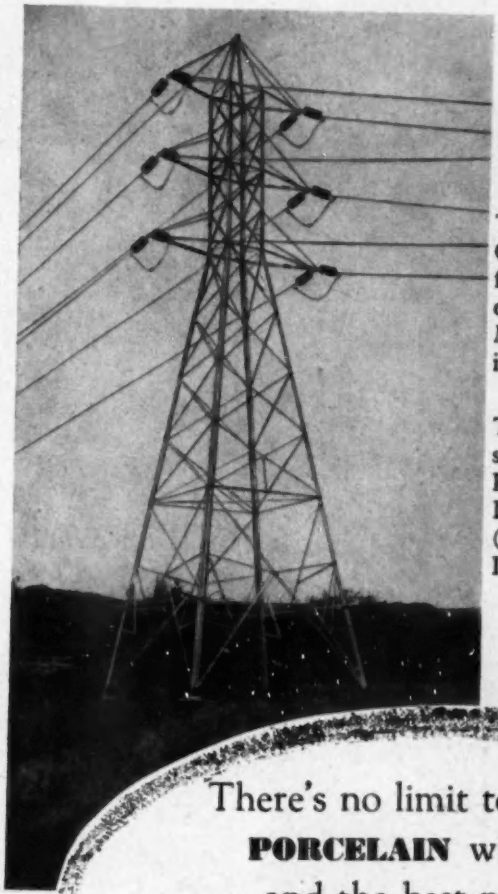
VENNER LIMITED · Kingston By-Pass, New Malden, Surrey
Telephone: MALden 2442



The photograph shows T.T. porcelain Cap and Pin Insulators on one of the first 66 kV Overhead Lines to be erected in the British Isles—a line from Maentwrog to Wrexham which is still in use after a quarter of a century.

Taylor Tunnicliff & Co. Ltd. will also supply the Insulators for the latest B.E.A. 275 kV Super Grid Line from Iver via Weybridge to Melksham. (Main Contractors: Balfour Beatty Co. Ltd., London.)

There's no limit to the **TIME**
PORCELAIN will **LAST**
and the best porcelain
is made by
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C'est magnifique . . .

MAIS CE N'EST PAS LA GUERRE . . .

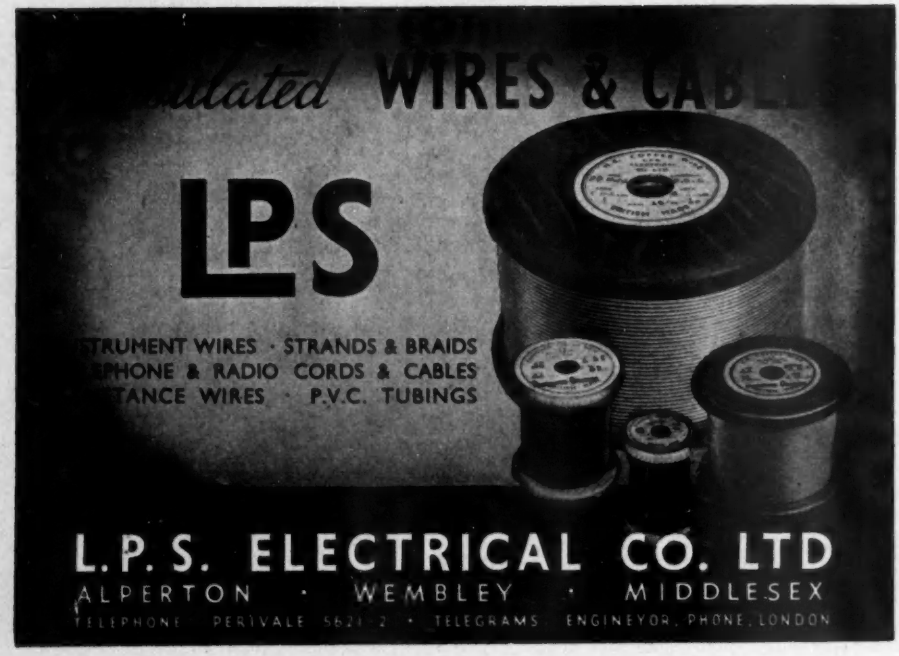
What does it mean? Who said it? Does it matter? It simply expresses, ASTRAL-Ogically, our conviction that this is no war against rising prices . . . it is a massacre.
The famous little 38 guinea ASTRAL brought refrigeration home to countless families who can still hardly believe their good fortune . . . NOW the highly competitive FREESTANDING model will turn the ice-cold war into a rout . . . route it through your showrooms. And the price? That is the spearhead of attack: wait for it:—

£44. 18. 0. (tax paid) . . . . C'est magnifique.

★ **National advertising between November 30 and December 12 in the Daily Mirror, Daily Mail and the Daily Express will support this AND the now famous table top ASTRAL you sell so well . . . Make sure you have them both on display.**

THE NEW
FREESTANDING
Astral **REFRIGERATOR**

PRODUCT OF ASTRAL EQUIPMENT LTD., 96 BUCHANAN STREET, GLASGOW C.1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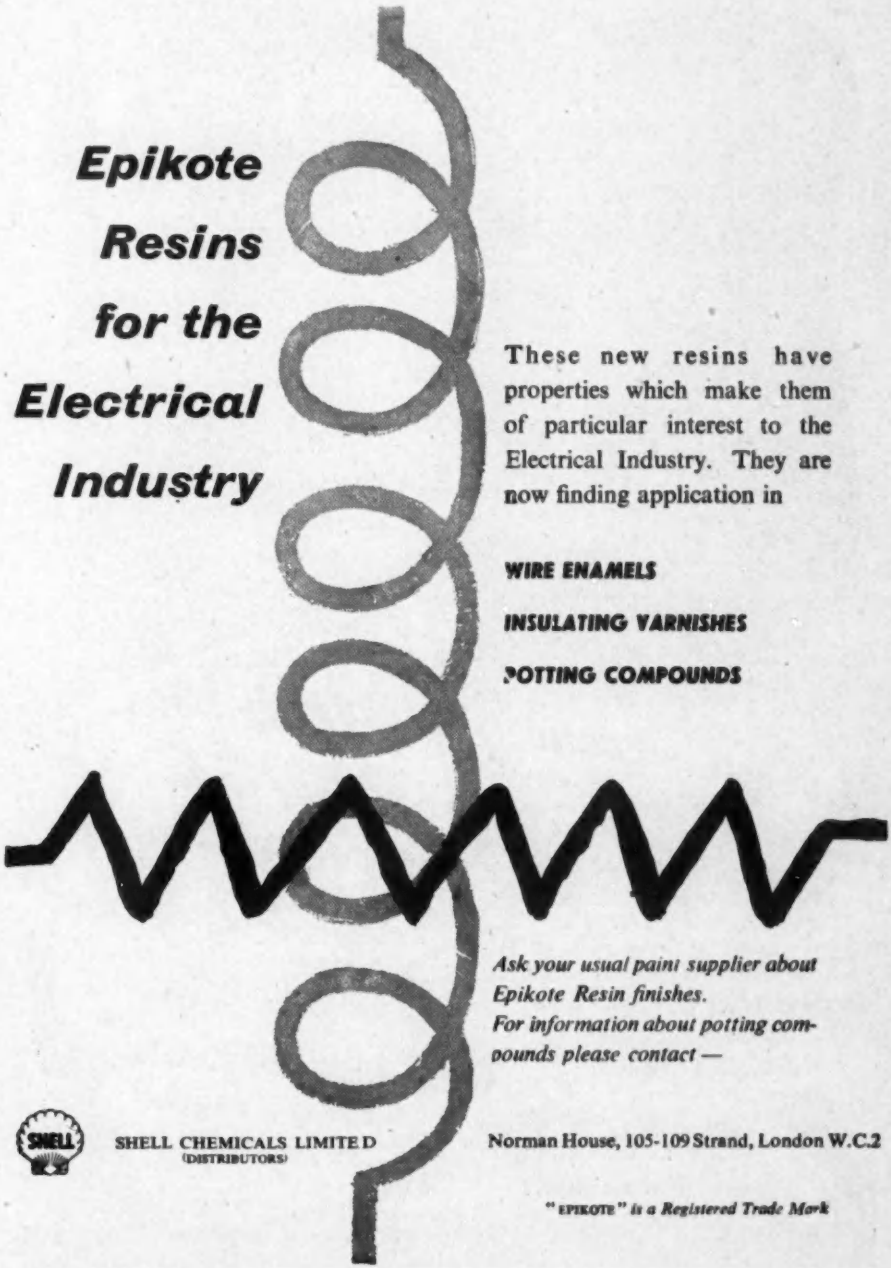
Epikote Resins for the Electrical Industry



These new resins have properties which make them of particular interest to the Electrical Industry. They are now finding application in

WIRE ENAMELS

INSULATING VARNISHES

POTTING COMPOUNDS

Ask your usual paint supplier about Epikote Resin finishes.
For information about potting compounds please contact —

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(DISTRIBUTORS)

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SANDASTEEL
LIGHTWEIGHT
FUSE BOARDS
Incorporating the well kn
"SANDASPEED DUPLEX" FUSES
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WEDNESBURY
FULL RANGE
now available in
15 amp. 30 amp. and
60 amp. sizes
★ The highly competitive prices will be sent on request
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The BEA'S First Semi-Outdoor Power Station

INCE POWER STATION will have four PF fired boilers, the first to be ordered by the British Electricity Authority for semi-outdoor operation. The progressive policy of the BEA coupled with enterprising engineering by ICL—

Will save STEEL, BRICKS and COAL

BOILERS. *550,000 lbs./hr., each at 975 psi and 925°F. Drums, firing floor and basement covered; remainder open to weather.*

MILLS. *Four LM14 mills (one as standby) to each boiler. Impax Hammer Mill used for lighting up.*

Enterprising Engineering by

INTERNATIONAL COMBUSTION LTD

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Salter have capacity for close grained grey iron castings produced in any weight up to 5 cwt. These castings are designed to allow for high-speed machining, and have a good surface finish—thus they are most suitable for use in the Electrical Industry and for general engineering purposes.

SALTER
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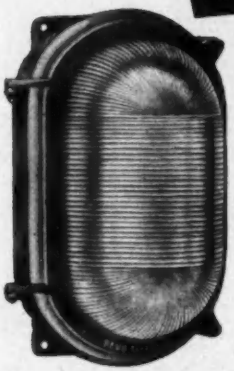
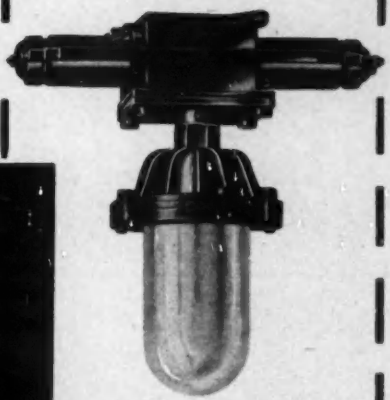
REVO REGD

INDUSTRIAL Lighting Fittings



THE ever growing demand for Revo Industrial Fittings testifies to the high quality of their manufacture and efficiency in service, the units illustrated below being typical examples from a wide range designed to cover all purposes.

(*Left*)
C13558—A weatherproof Bulkhead fitting in aluminium alloy with smooth surfaced prismatic glass for 60w—100w lamps.



Revo Flameproof fittings, similar to that shown above, illuminate the roadway in Peckfield Colliery (*left*)

Descriptive Literature available upon request.

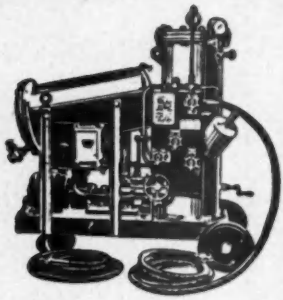
(*Above*)
"Trufolite" Reflector fittings for one or two 40w or 80w 5ft. fluorescent lamps are designed for direct ceiling mounting of chain or tube suspension

REVO ELECTRIC CO. LTD. , TIPTON , Staffs.

Manufacturers of : Electric Cookers • Domestic Appliances • Switch and Fuse Gear
Electric Fans • Public Lighting Equipment • Industrial Lighting

Cold Filtration of Insulating Oils

The insulating value of used transformer and switch oils by one passage through the Metafilter is raised to a higher break-down voltage than the new oil.
The plant is purely mechanical and extremely simple in operation.



Capacities from 20 gallons to 1,000 gallons per hour.

METAFILTRATION

PHONE: HOUNSLOW 1121/2/3
GRAMS: METAFILTER, HOUNSLOW

THE METAFILTRATION COMPANY LIMITED, BELGRAVE ROAD, HOUNSLOW, MIDDLESEX

PITMAN

The M.K.S. System of Units

A Guide for Electrical Engineers. By T. MacGreevy, M.Sc.Tech., M.I.E.E. In this book a full explanation of the M.K.S. system is given, and a case made out for its adoption by electrical engineers and physicists. 21s. net.

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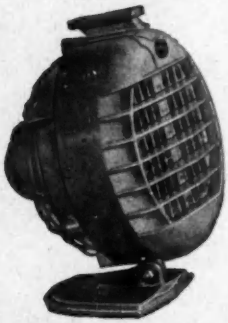
Sir Isaac Pitman & Sons, Ltd.
Parker Street • Kingsway • London, W.C.2

There's always a ready and steady sale for

SPIRAL TUBE
Unit Heaters



THE 'SPIRALUXE' 2 or 3 kw UNIT HEATER

A smart portable and highly efficient heater suitable for quick warm-up of offices, board rooms, etc. Special 'Spiraluxe' features are: Built-in switch to run fan only. Automatic thermal safety cut-out. 18 months' guarantee. *Finished Blue or Bronze.*

Portable or Wall Mounting Models.

Write for illustrated List No. ER.93 together with details of generous trade terms.

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Is Yours to Hand?
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These are three recent Nettle publications, a leaflet describing the new weather-proof rubber batten socket and plug, the Coronation issue of our comprehensive catalogue and a new price list.

Requests for these and all other Nettle publications will receive prompt attention. Your enquiries are invited

NETTLE ACCESSORIES *Ltd.*
HARPER ROAD WYTHENSHAWE MANCHESTER

PHILIPS LIGHTING NEWS

PHILIPS FLUORESCENT LAMP STARTER CUTS MAINTENANCE COSTS

Fits practically any holder

The Philips K.3080 Fluorescent Lamp Starter ("Glow" type) cuts maintenance costs in two ways.

1. LONGER LAMP LIFE

The controlled delay (patent applied for), built into the Philips Starter, ensures that the lamp electrodes are properly heated before the mains voltage is applied between them. This gives "clean" starting, and lengthens the life of the lamp, since repeated "blinking" inevitably reduces lamp life.

2. EASIER STOREKEEPING— SIMPLIFIED STOCKS

Any starter, either glow type or thermal, designed for a 4-contact holder, for 80W. 5 ft., 40W. 4 ft., 30W. 3 ft., 200-250 A.C. lamps can be replaced by the Philips K.3080. Think what this means in simplifying stocks—one type for practically every purpose. With just this one type of starter in his kit, the maintenance man can cope with any need.

Sensible Packing

Each starter is packed in a separate protective carton carrying technical description and circuit diagram. The outer box, containing twelve starters, makes a compact, convenient pack for the stores, and an attractive display for the counter.

PHILIPS

PHILIPS ELECTRICAL LIMITED

LIGHT GROUP · CENTURY HOUSE · SHAFTESBURY AVENUE · LONDON · W.C.2

RADIO AND TELEVISION RECEIVERS · TUNGSTEN, FLUORESCENT, BLENDED AND DISCHARGE LAMPS AND LIGHTING EQUIPMENT · 'PHILISHAVE' ELECTRIC DRY SHAVERS · 'PHOTOFLUX' FLASHBULBS, ETC.

(I.D.206)

MOTOR STARTING

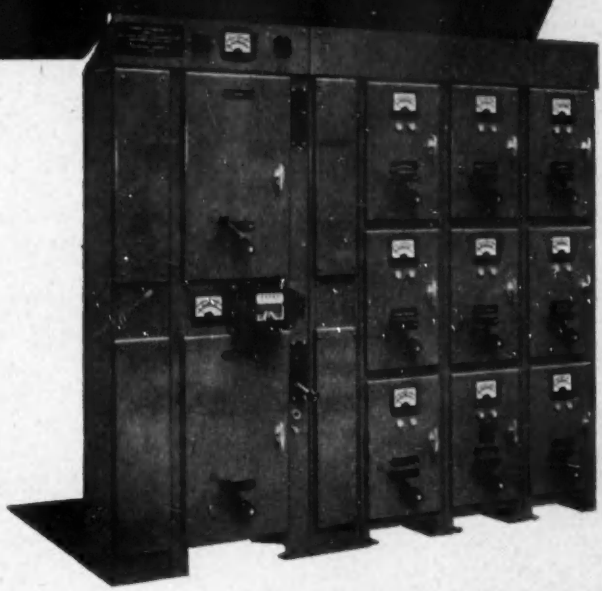


Illustration shows group of 30-ampere Direct-on Contactor Starters in triple tier formation aligned with 200-ampere Capacity Circuit Breakers in double tier, showing the uniformity which can be achieved with units of widely differing current ratings.

BELMOS

30-AMPERE STARTERS HAVE

- Individual Interlocked Isolation
- Throughgoing Busbars provide extension facilities
- 4-inch Square Type M.I. Ammeters
- Magnetic Overload Relays with Oil Time Lags
- Facilities for Remote Control

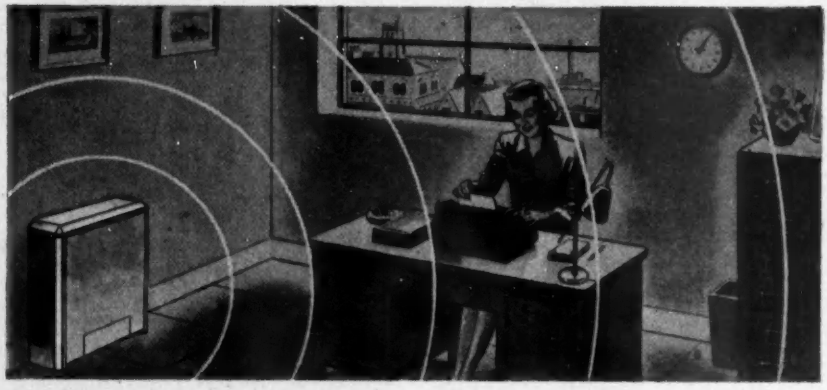
the **Belmos**

BELLSHILL · LANARKSHIRE

LONDON OFFICE: COLUMBIA HOUSE · ALDWYCH · LONDON · W.C2.

stores heat *during night 'off-peak' periods*

This entirely new G.E.C. heater, the 'Nightstor', stores heat during the night when favourable tariff concessions can be obtained. It provides in effect a central heating system which needs no attention at all. It is cheap to install and economical to run.



gives out heat *during the working day*

Thoroughly charged during the night the 'Nightstor' heater uses no electricity during the day; but it continues to provide a consistent flow of beneficial warmth everywhere. Your staff are assured of immediately comfortable working conditions, your fuel bill will be less and you will contribute to the prevention of "smog". *This new and efficient heater is ideal for offices, schools, factories, hospitals etc. The 'Nightstor' heater can solve your heating problem* this winter! Send for details

Nightstor

HEATER a G.E.C. product

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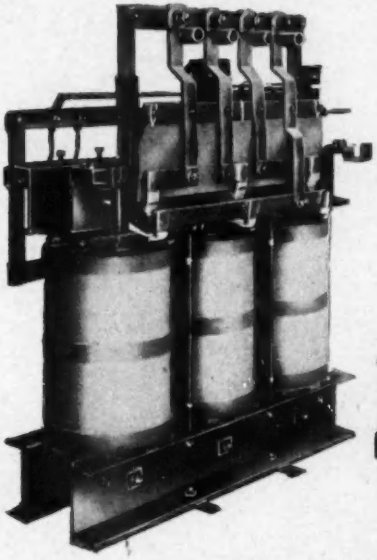
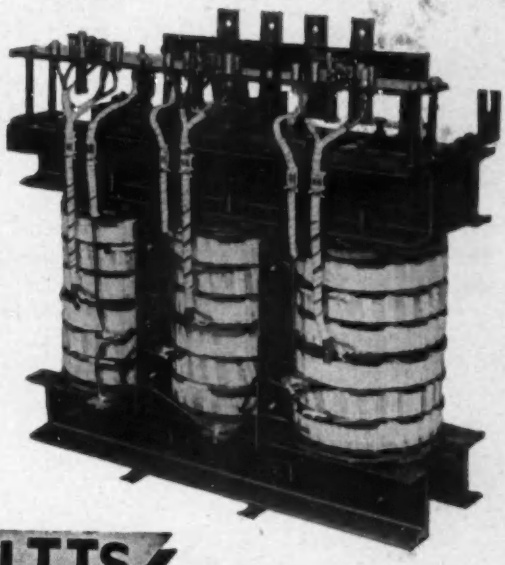
LINDLEY THOMPSON *Core Type* TRANSFORMERS

Nothing has been overlooked in the manufacture of these Core Type Transformers. Winding, cooling, insulation, drying . . . every factor which makes for the utmost efficiency has been considered.

The functions and characteristic features of these Units are fully described in the Brochure of the LINDLEY THOMPSON TRANSFORMER & SERVICE CO. LTD. A copy will gladly be sent to any Electrical Engineer or Executive who requests it.



600 kVA, 3-phase, 50 cycles.
Voltage ratio 6,600-433.
With off-load tapping switch.



100 kVA, 3-phase, 50 cycles.
Voltage ratio 6,600-433.

LTTS Co.

TWO YEARS GUARANTEE WITH ALL TRANSFORMERS

THE LINDLEY THOMPSON TRANSFORMER & SERVICE CO. LTD.
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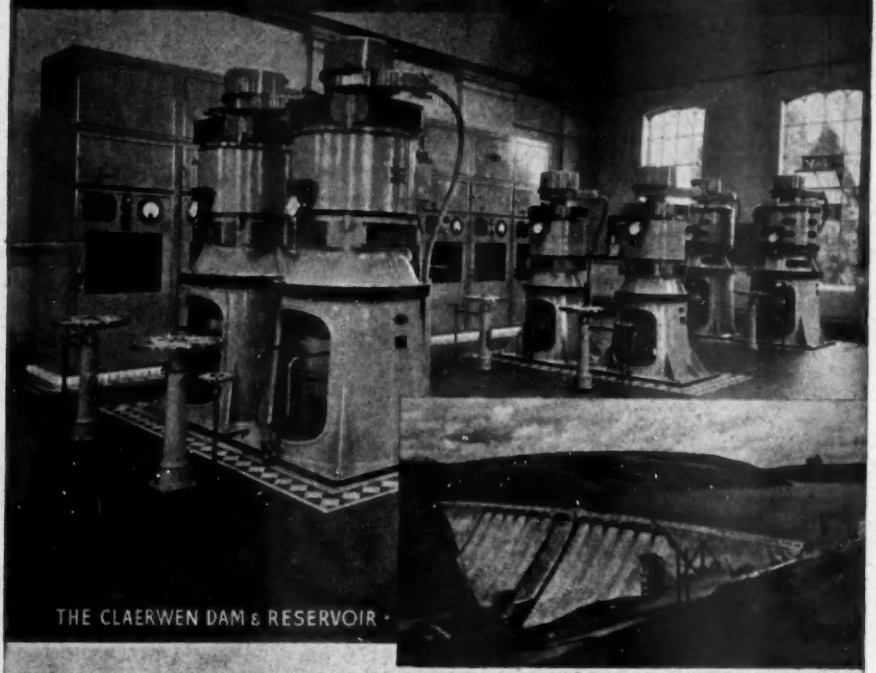
ECC AT FRANKLEY PUMPING STATION



THE CLAERWEN DAM & RESERVOIR

2-410 BHP, 2-340 BHP and 2-170 BHP ECC motors driving Sulzer vertical centrifugal pumps

This installation included H.T. and L.T. switchgear, automatic motor control gear, stepdown transformers and rectifiers for D.C. services, all of ECC manufacture.

The function of the Frankley pumps is to lift a proportion of the water derived by gravitation from the Elan reservoirs and the new Claerwen reservoir to high level service reservoirs in Birmingham after its 73 mile passage through the Elan aqueduct to the raw water storage reservoirs and treatment works at Frankley.

Reproduction by courtesy of City of Birmingham Water Department.
Chief Engineer, Mr. C. A. Risbridger, B.Sc., M. Inst. C.E.

ESTABLISHED 1882

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BUSHBURY ENGINEERING WORKS
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ENGLAND

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ECC 2637

Manufacturers of Rotating Electrical Machinery, Switch and Control Gear, Rectifiers and Transformers.

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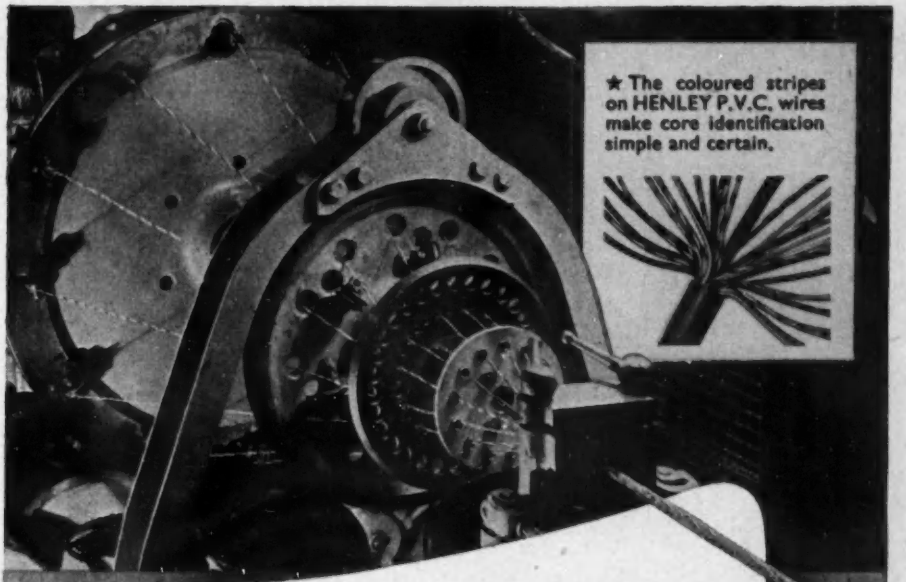


★ The coloured stripes on HENLEY P.V.C. wires make core identification simple and certain.

HENLEY

THERMOPLASTIC WIRES and CABLES

Henley's manufacture a very comprehensive range of wires, cables and flexibles insulated with P.V.C. and Polythene for Telecommunications, High Frequency, Television Down Leads, Equipment Wires, etc. Where colour identification of cores is required, the Henley dual marking method provides an extremely wide range of colour combinations. If you have a problem concerning thermoplastic cables Henley's advice is readily available.

★ Ask for Folder 484 describing HENLEY Colour Striped P.V.C. Wires.

W. T. HENLEY'S TELEGRAPH WORKS CO. LTD., 51-53 HATTON GARDEN, LONDON, E.C.1

These three fittings are recent additions to the ELECO range of street lighting lanterns and embody all the latest improvements as recommended in B.S. Specification 1788 for lantern construction.

The WELWYN lantern has been re-styled and the refractor springs are totally enclosed to give complete protection against all weather conditions, also giving the interior of the fitting a clean appearance.

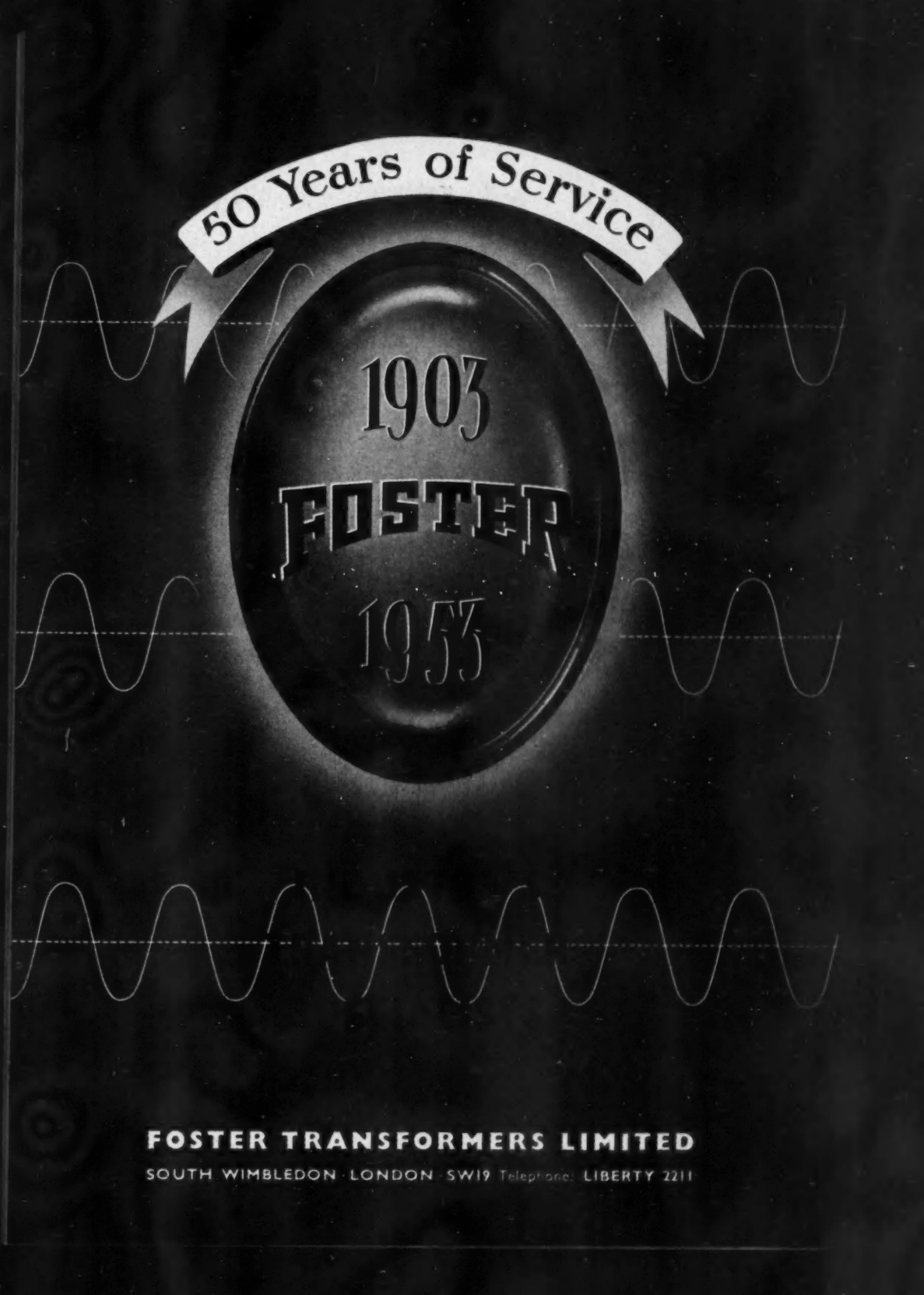
The LANCASTER lantern is a controlled cut-off fitting which reduces glare to a minimum. The distribution from the horizontal Mercury discharge lamp in the upper half of the fitting is reflected by means of specially designed reflectors through the scientifically designed refractor bowl giving high and even illumination on the road surface.

The GOLDEN RAY MARK III lantern is completely dustproof and is available for all sizes of sodium discharge lamps. The "Perspex" refractor plates have machined "Perspex" prisms sealed by a special process to the interior of the outer enclosing "Perspex" bowl and because of the unique dustproof qualities of this fitting, maintenance costs are reduced to a minimum.

Engineering and Lighting Equipment Co. Ltd.

SPHERE WORKS, ST. ALBANS, HERTS

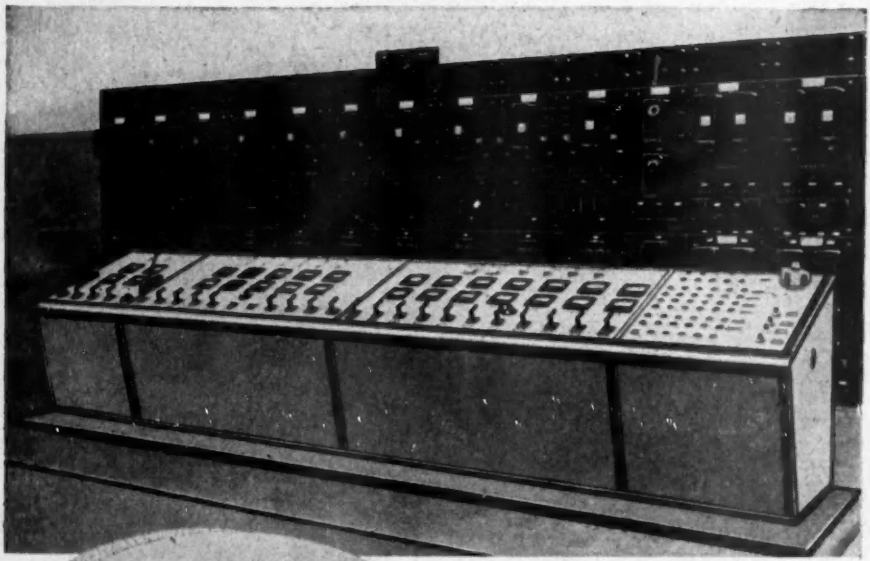
Telegrams: VOLTARCON, ST. ALBANS ELECO *Telephone*: ST. ALBANS 2258/2259

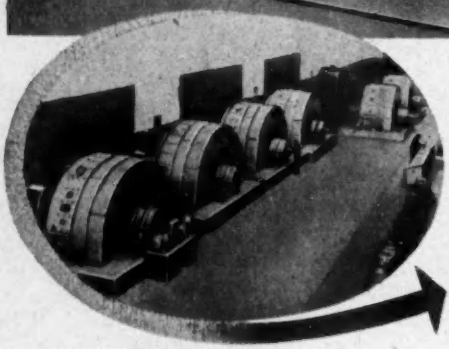


FOSTER TRANSFORMERS LIMITED

SOUTH WIMBLEDON · LONDON · SW19 Telephone: LIBERTY 2211

CONTACTOR CONTROL for Heavy Industry





The upper illustration shows the supervisory control desk in the Motor room and a section of the control panels (in all approx. 195 ft. frontage) at the Abbey Works of The Steel Company of Wales, Ltd.—the largest rolling mill in Europe and the most modern in the world. BTH contactor equipments control the drives for the 80-inch 6-stand hot strip finishing mill, comprising six BTH motors totalling 28,000 h.p. (inset) supplied from BTH rectifiers with a total capacity of 21,000 kW. For more than half a century BTH has held a position of leadership in the development of automatic "fingertip" control of heavy electric plant through the medium of contactors. These contactors, designed by experts, are proved by protracted "life tests" before going into service.

Where only the best is good enough—

Specify BTH Contactor Control

THE

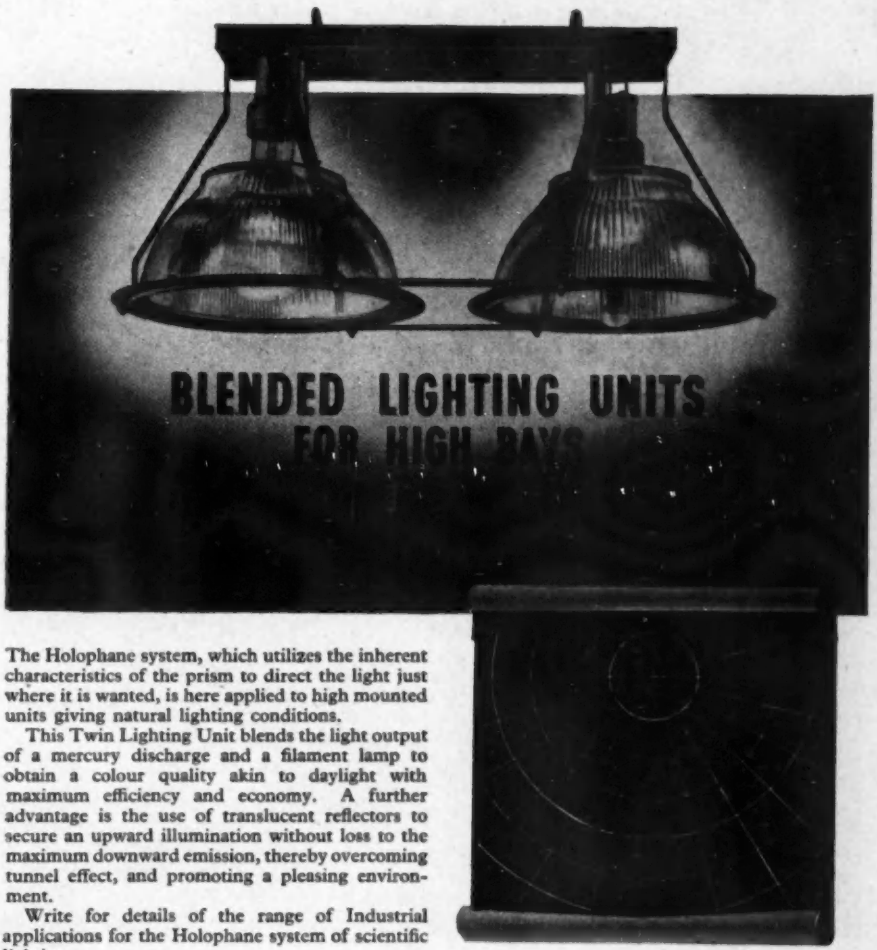
BRITISH THOMSON-HOUSTON

COMPANY LIMITED, RUGBY, ENGLAND

Member of the AEI group of companies

A499

NATURAL LIGHTING CONDITIONS



The Holophane system, which utilizes the inherent characteristics of the prism to direct the light just where it is wanted, is here applied to high mounted units giving natural lighting conditions.

This Twin Lighting Unit blends the light output of a mercury discharge and a filament lamp to obtain a colour quality akin to daylight with maximum efficiency and economy. A further advantage is the use of translucent reflectors to secure an upward illumination without loss to the maximum downward emission, thereby overcoming tunnel effect, and promoting a pleasing environment.

Write for details of the range of Industrial applications for the Holophane system of scientific lighting.

HOLOPHANE LIMITED

SCIENTIFIC ILLUMINATING ENGINEERS

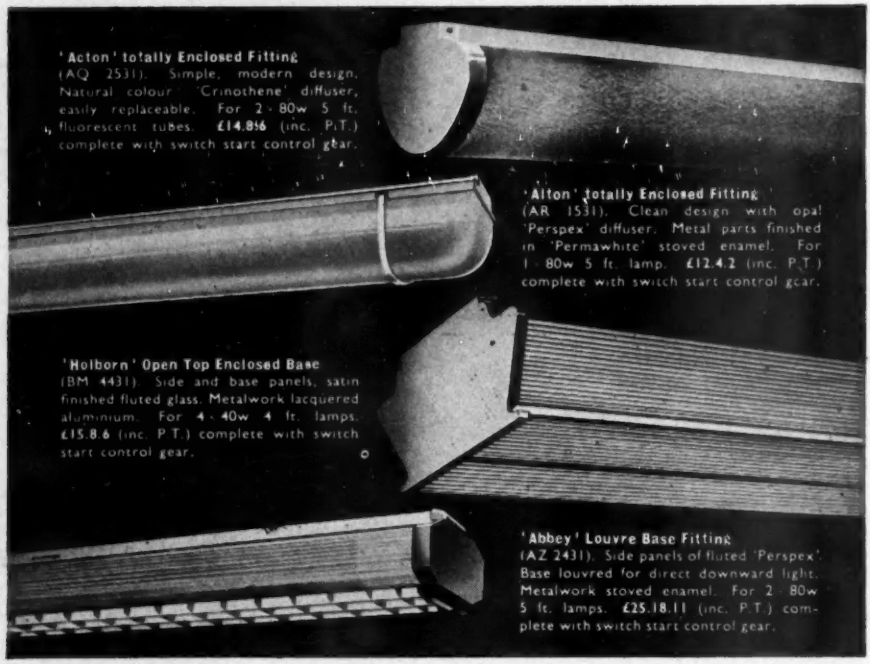
ELVERTON STREET, WESTMINSTER, LONDON, S.W.1

Phone: VICtoria 8062 Grams: Holophane Sowest London

See how well the Crompton FITTING matches the job . . .

BY APPOINTMENT MANUFACTURERS OF ELECTRIC LAMPS TO THE LATE KING GEORGE VI

See how the Crompton fitting brings you a better answer for its particular job — in fine materials, finish and performance. Even if you paid a great deal more for it, you would still be saving money on your lighting. But Crompton fittings cost no more than most others. Here are just four of many fittings for offices, shops and showrooms.


'Acton' totally Enclosed Fitting (AQ 2531). Simple, modern design. Natural colour 'Crinothene' diffuser, easily replaceable. For 2 - 80w 5 ft. fluorescent tubes. £14.8.6 (inc. P.T.) complete with switch start control gear.
'Alton' totally Enclosed Fitting (AR 1531). Clean design with opal 'Perspex' diffuser. Metal parts finished in 'Permawhite' stoved enamel. For 1 80w 5 ft. lamp. £12.4.2 (inc. P.T.) complete with switch start control gear.
'Holborn' Open Top Enclosed Base (BM 4431). Side and base panels, satin finished fluted glass. Metalwork lacquered aluminium. For 4 - 40w 4 ft. lamps. £15.8.6 (inc. P.T.) complete with switch start control gear.
'Abbey' Louvre Base Fitting (AZ 2431). Side panels of fluted 'Perspex'. Base louvred for direct downward light. Metalwork stoved enamel. For 2 - 80w 5 ft. lamps. £25.18.11 (inc. P.T.) complete with switch start control gear.

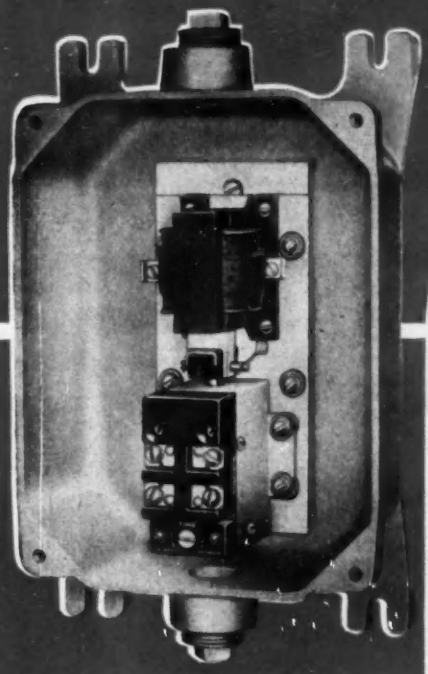
Switch to

Crompton LIGHTING FITTINGS

ELECTRICAL EQUIPMENT

CROMPTON PARKINSON LTD. · CROMPTON HOUSE · ALDWYCH · LONDON, W.C.2

Telephone : CHAncery 3333 *Telegrams : Crompark, Estrand, London*



This single-pole change-over switch, in which 'make' or 'break' timing can be set to operate over a range of 1/6th to 180 seconds, comprises a compact pneumatic system and a robust solenoid mounted in a fully-tropicalised case of cast-aluminium.

It is used for

controlling accelerating-contactors of motor starters; timing the opening and closing of valves in refrigeration plant; controlling sequential process operations; and for the delayed-starting of loop-circuit electrical equipment.

ELECTRO METHODS LTD
OF STEVENAGE

—the first name for

PNEUMATIC

TIME-DELAY RELAYS

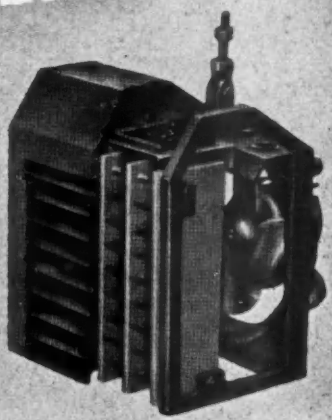
Comprehensive technical data gladly forwarded on request.

Now available for PROMPT DELIVERY

ELECTRO METHODS LTD. (Division PR5) CAXTON WAY, STEVENAGE, HERTS.
PHONE · STEVENAGE 780

UNIT HEATERS

Made in 3 sizes 3, 5 and 10 Kw



- ALL ELECTRIC
- SIMPLE TO INSTAL
- ECONOMICAL TO RUN
- AUTOMATIC CONTROL
- REFRESHING ATMOSPHERE IN SUMMER
- AUGMENTS EXISTING HEATING SYSTEMS
- MINIMUM OF MAINTENANCE

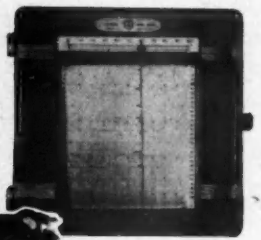
SEND FOR LIST: 57

CARTER & COMPANY (NELSON) LTD

NELSON LANCASHIRE TELEPHONE 638

BURGESS MICRO-SWITCHES

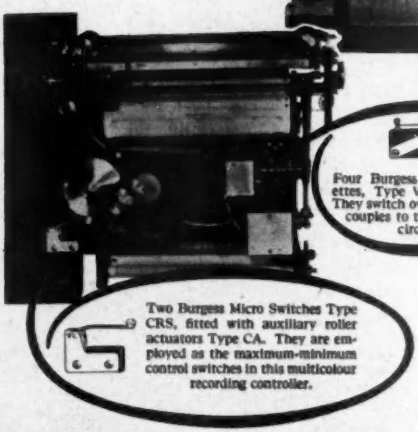
Industry's Automatic Choice



THE ETHER "WIDE STRIP" TYPE WSP/E ELECTRONICALLY-OPERATED POTENTIOMETER

Ether Ltd. use Burgess Micro Switches for electrical control in this and their other high quality products because—like all manufacturers of repute—they believe in having the best component equipment obtainable.

In your products too there are probably many points where a Burgess Micro Switch could give you similar trouble-free service; if so, there is almost certainly a suitable model for your application described in our Catalogue No. 50/8—please write for a copy.



Four Burgess Micro Switchettes, Type V3, type VLR1. They switch over two thermo-couples to the amplifier circuit

Two Burgess Micro Switches Type CRS, fitted with auxiliary roller actuators Type CA. They are employed as the maximum-minimum control switches in this multicolour recording controller.

BURGESS

MICRO-SWITCHES

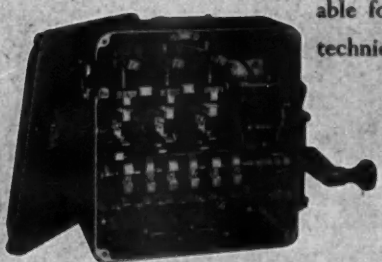
BURGESS PRODUCTS COMPANY LIMITED

MICRO-SWITCH DIVISION, DUKES WAY, TEAM VALLEY, GATESHEAD, 11 TELEPHONE: LOW FELL 75322/3

When an air-break star-delta starter is better . . .

. . . a METROVICK ASD is best

The ASD series of Metrovick starters is not only made to B.S. 587 but to the standard of design and construction which Metrovick rigorously maintain in all their products. The ASD starter is available for immediate delivery and invites close inspection. Full technical details will be sent on request.



Type ASD starters are suitable for squirrel-cage motors up to 25 H.P., 650 V. The starters are intended for use in general industrial applications.

METROPOLITAN-VICKERS ELECTRICAL COMPANY LIMITED TRAFFORD PARK, MANCHESTER, 17

METROVICK *Control Gear for all Motor Drives*

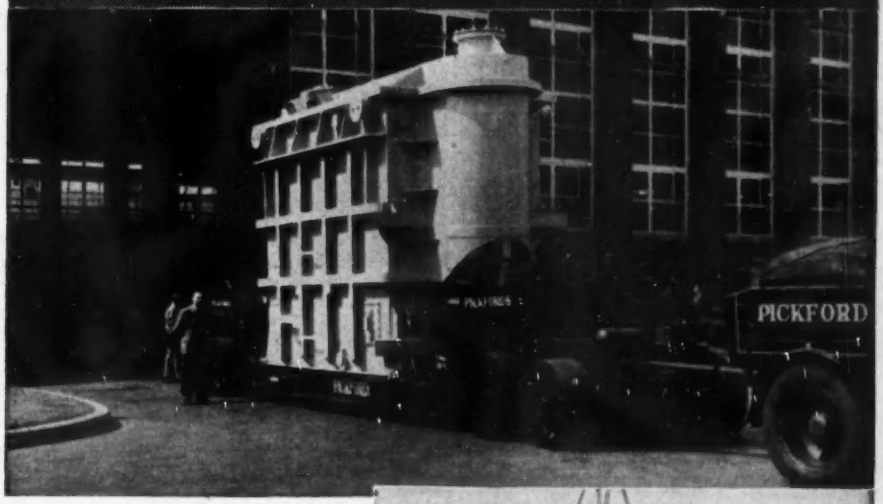
Another Featherweight Cable

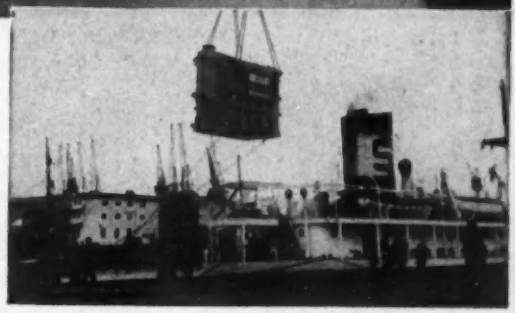
Single and Multi-pair Telephone Distribution Cables—Copper Conductors—Insulated with Polythene-Cores coloured for easy Identification—Polythene Taped—Screened with Aluminium Tape—Protected with a sheath of Polythene—for direct burial in the ground. A further protection comprising two impregnated cotton braidings can be provided where the cable is to be suspended overhead from a Catenary. Joint boxes are available for all sizes of cable.

STERLING

STERLING CABLE COMPANY LIMITED
ALDERMASTON BERKSHIRE
Telephone Reading 1000 Telegrams Sterling Phone Reading

301,400 volts





The first of four 71,000 kVA 301,400 volt—THE HIGHEST EVER MADE IN BRITAIN—singlephase Ferranti Generator Transformers for the Alcan Project, Canada has been shipped to Kemano, British Columbia. Three 37,000 kVA, 275,000 volt step down Transformers are also being supplied for use at Kitimat.

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Wards are engineers and merchants. As manufacturers and distributors of machinery and machine tools, iron, steel and non-ferrous metals, building materials and contractors' plant, rails and railway accessories, foundry plant and supplies and many other things — Wards are *suppliers* of industry's needs.

As engineers engaged in works dismantling, factory planning, structural steelwork, siding construction, road-making and the like — Wards offer skilled *service*.

To complete the picture, the Company produces valuable raw material as the result of its scrap distribution and shipbreaking activities.

Briefly, in one way or another,

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Serve All Industries

THOS. W. WARD LTD

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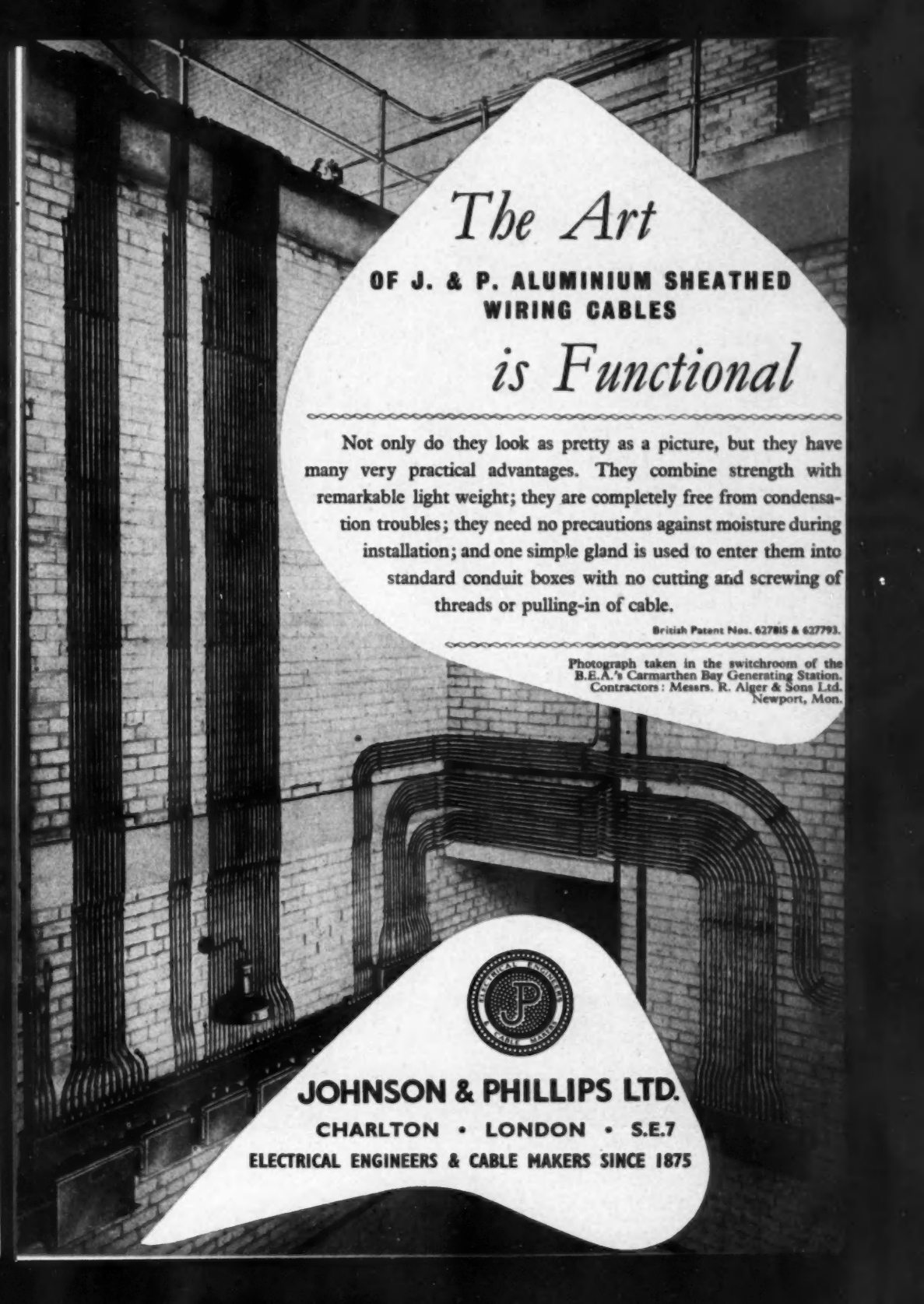

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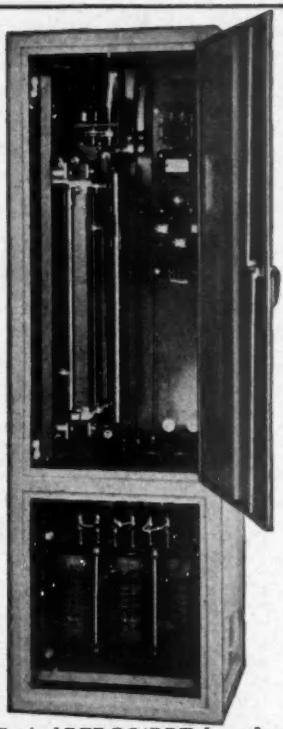

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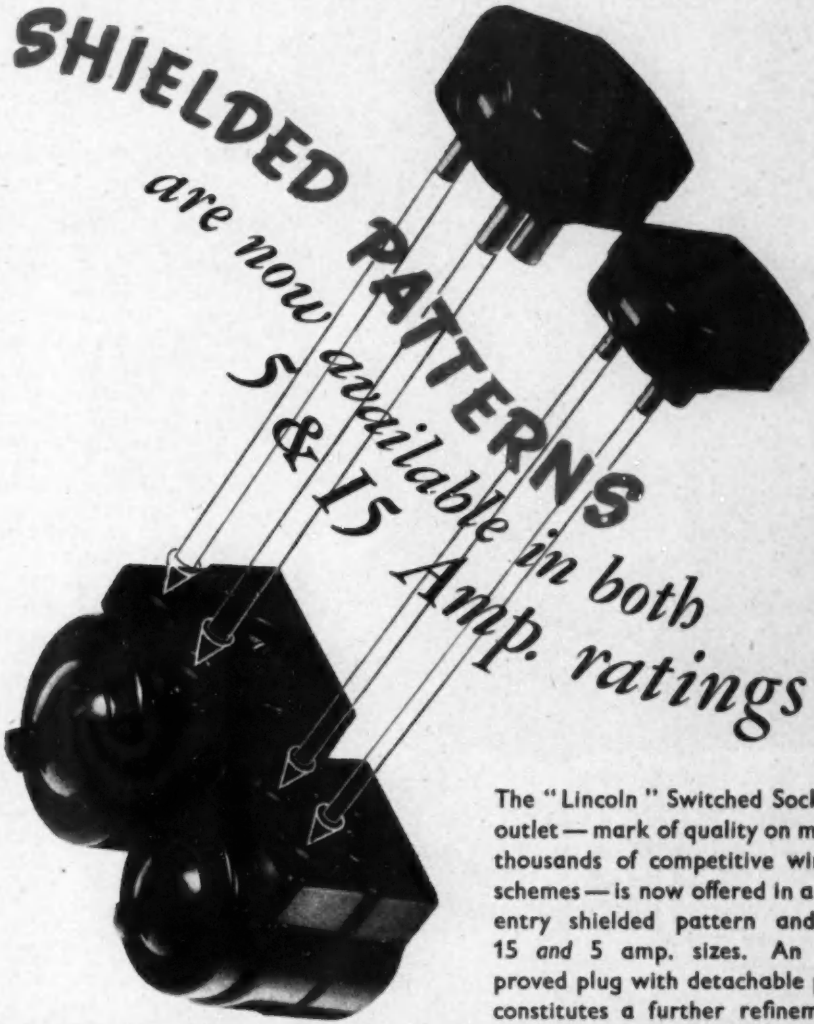

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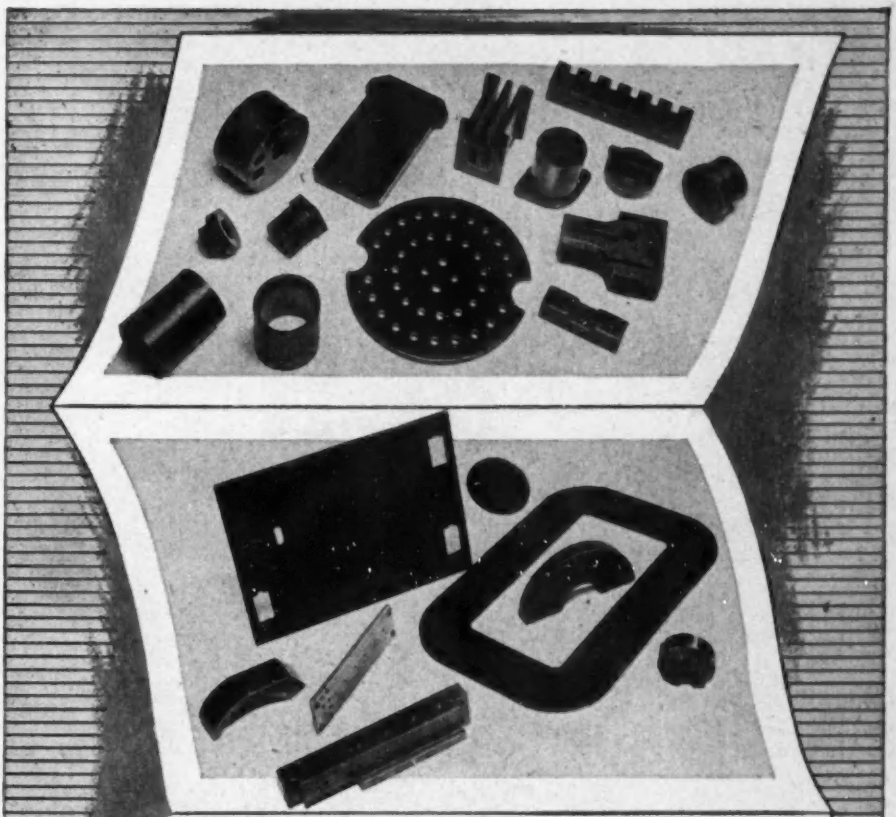

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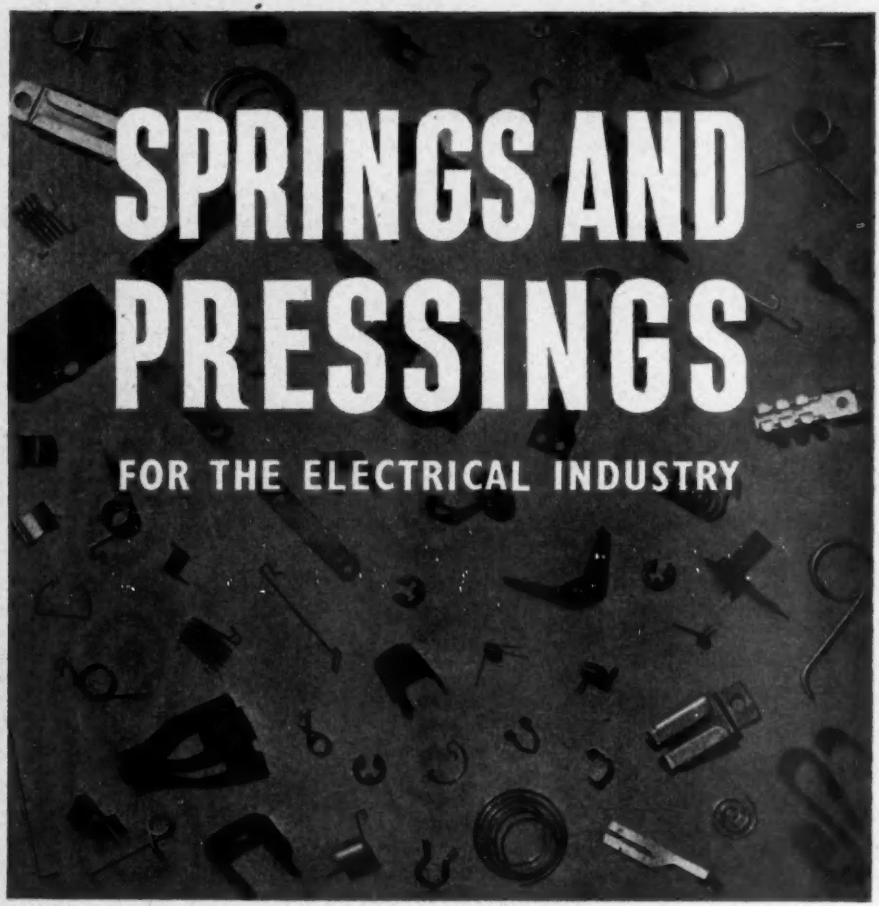

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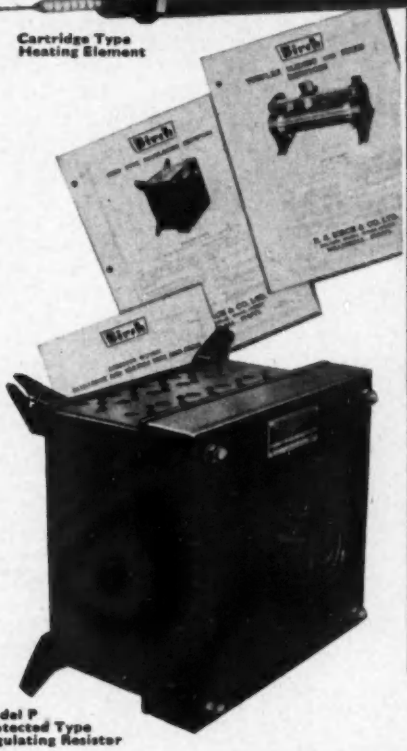

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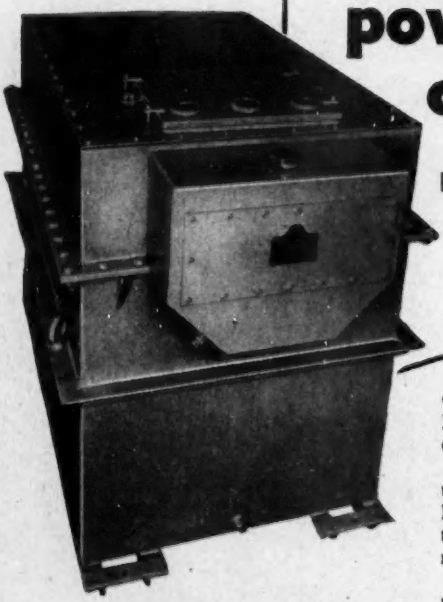

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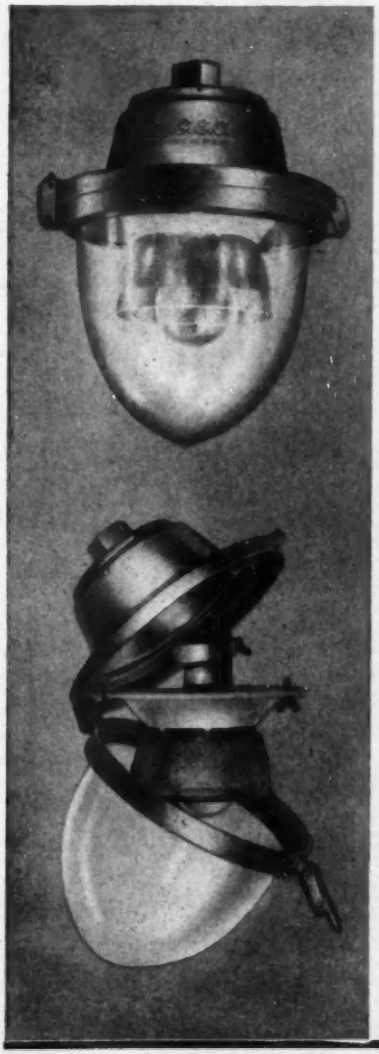

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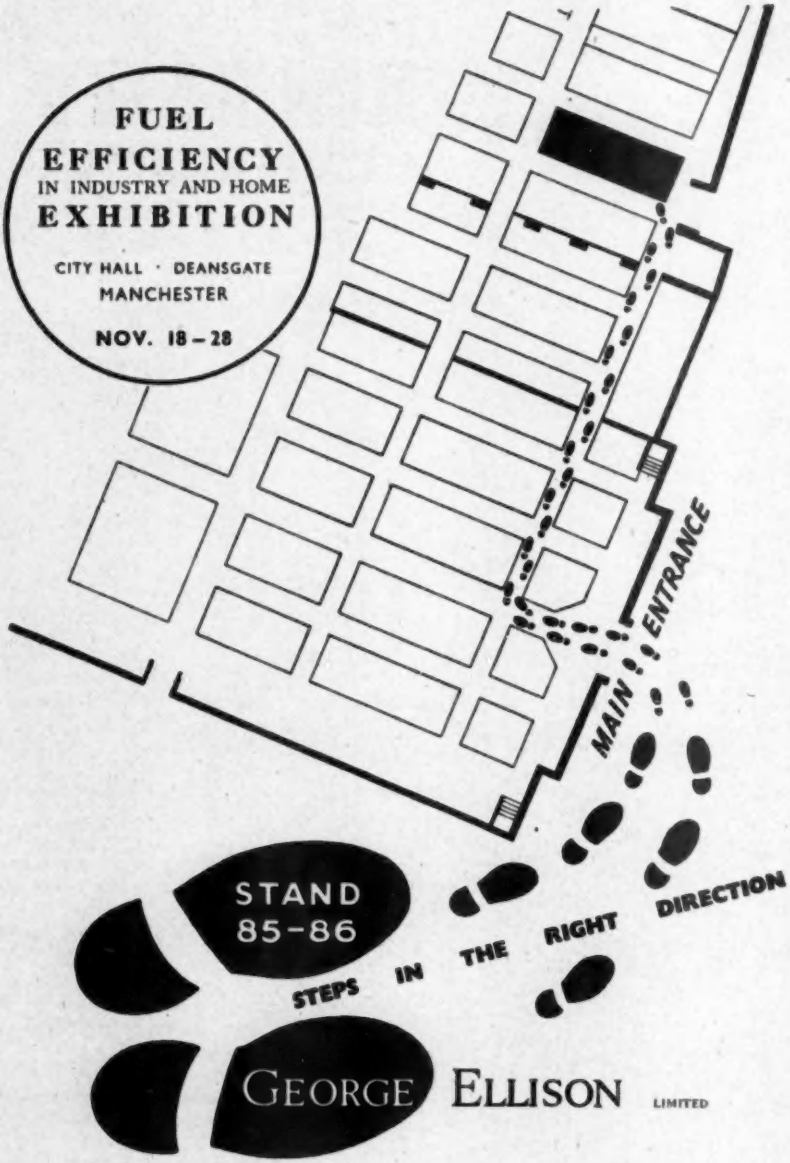

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ELECTRICAL TIMES

Volume 124 No. 3236 12 NOVEMBER, 1953

PUBLISHED EVERY THURSDAY

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ESTABLISHED 1891

SUBSCRIPTION RATES—United Kingdom and Overseas £2 10s. 0d. per annum. Canada C$7·50c., U.S.A. $7·50c. per annum. Subscriptions are payable in advance and may commence with any issue throughout the year. Overseas subscriptions may be paid to The Electrical Times Limited by banker's draft, cheque or international money order. Single copies are obtainable, price 9d. each.

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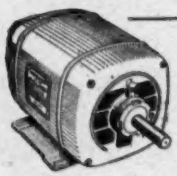

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Editorial

ANTI-ELECTRIC ECONOMICS

THEORETICAL economists cannot resist for long the lure of reorganising the tariff structure of the electricity supply industry. Somehow, they feel that its apparently simple form should be readily amenable to textbook rules, and so they attempt to set it aright in print. Early last year the United Nations launched an attack of this kind on British practice in charging for electricity; today is published by an Oxford economist a book, "The Price of Fuel" which is likely to spark-off another surge of anti-electric polemics. The author is a devotee of the theory of marginal cost pricing—that same theory which led one-half of the Ridley Committee to recommend a rise of £1 per ton in the price of coal—and he has a strong contempt for the alternative, common-sense approach of charging the average cost of production. Arguing from this basis, he considers domestic electricity to be far too cheap, and clamours for a three-period time-of-day tariff, a seasonal cost differential that makes the Clow surcharge seem small beer indeed, and various other devices which the industry has for long considered and rejected as impracticable.

AN ANSWER REQUIRED

THE best answer to such suggestions so far as reasonable people are concerned is that given by Mr. R. Y. Sanders at Bournemouth last year—significantly, in a paper which is savagely attacked in this new book. "The advocacy of this type of tariff," said Mr. Sanders, "appears to spring from the mental attitude which relies on restrictions to obtain improvements." The history of electricity supply shows that encouragement of expansion can effect improvements, too. Yet it is not enough to give an answer for the reasonable reader alone. There can be little doubt that this new restrictive argument will provide ammunition for new and powerful attacks by those already ill-disposed to electrical comfort in the home, for it is presented in a persuasive manner, and must seem well-documented and knowledgeable to the casual reader. An authoritative exposure of its fallacies is an urgent need, and those in authority in our industry should ensure that there is no delay in providing it.

ELECTRICITY MUST HELP

MODERNISING the many old houses which are structurally sound, but are hopelessly inconvenient to run, is an essential part of the Government's new housing policy as announced last week. It is an aim which electricity can help forward, provided the industry gives the right guidance and encouragement to landlords and to local authorities. Hot water, for instance, looms large in the amenities which improvements in properties must provide to qualify for Government grants in aid; whilst the conversion of rooms to new uses will inevitably involve extensions in wiring. In the Stockton and Croydon experiments, those interested in selling domestic solid fuel appliances have shown how their products can help to improve nearly derelict properties. There is no doubt that their success in converting houses and pleasing the tenants impressed many interested in the problem. Electricity should be able to handle such a conversion job still more effectively, because of its flexibility in providing energy just where it is required without major structural work. For the companion task of turning a large house into self-contained flats, it is without real rival. Yet the industry has not yet staged any comparable demonstration of how the task should be done. This omission should rapidly be repaired, so that contractors, boards and manufacturers may take their rightful part in serving the community in this new drive to ease the housing situation, helped by the promised Government publicity on the subject.

NEEDY WIRING

IT is the general practice amongst area boards to maintain domestic installations contracted for under pre-vesting assisted wiring schemes, but to initiate no new contracts of this type. Indeed some boards are attempting to rid themselves of all responsibilities of this nature, and are offering existing wiring free to the landlords and tenants concerned. The reason for this policy is to be found in present restrictions on capital expenditure: house wiring is an extra commitment which just cannot be financed within existing limits. All this would seem simple enough, but it now appears that the discontinuance of facilities for wiring hire is causing hardship for some poorer consumers. It is not always clear legally whether tenant or landlord is responsible for house wiring, and if a defect occurs, the one may be unable, and the other unwilling, to pay for the necessary repairs. At present the consumer in consequence possibly goes without electricity; under former schemes repairs might have been undertaken by the supply authority on easy repayment terms. This is surely not a situation which area boards will wish to see continue, and although it is by no means their responsibility alone, they might well co-operate with local authorities to search for some workable solution.

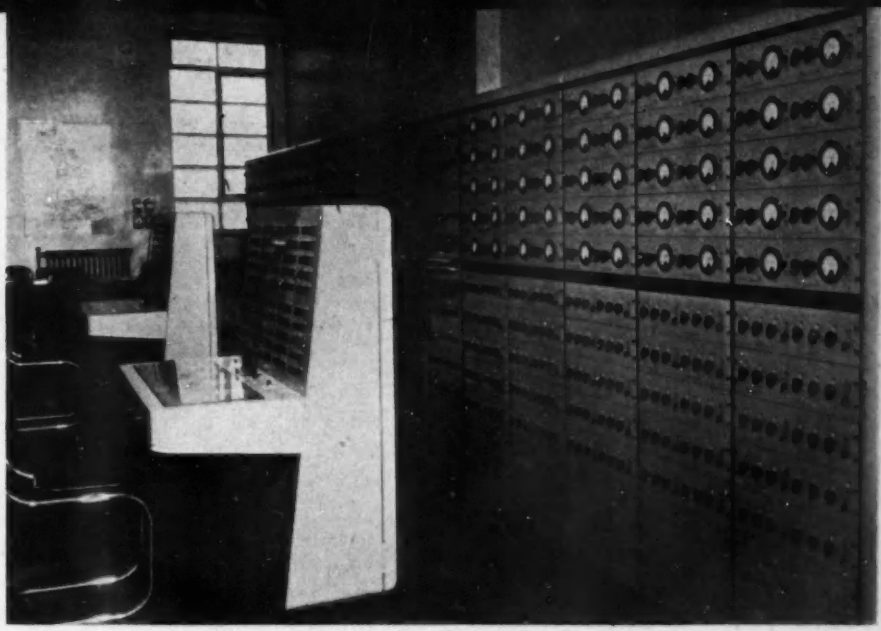
COST OF SURGES

INCREASED attention to transient voltages has been a feature of specifications of all types of h.v. plant in the past decade. Growing appreciation of the effect of surges in transmission systems has led to a stage where, as one speaker put it, in an I.E.E. discussion last week, the over-voltage test is little more than a check that nothing has gone seriously wrong during manufacture. There is, however, a serious difficulty involved in this concentration on impulse testing. Whereas the ratio of test over-voltage to normal system voltage is known, there is no such certainty as regards the ratio of test surge to the actual voltage wave that may stress insulation in service. Judging by comments offered on Mr. Cliff's paper on insulation co-ordination last Thursday, this is a subject on which transformer manufacturers are feeling rather strongly. They propose requiring their customers to restrict severely the surge voltages impinging on transformer insulation in service, either by the method of system operation or by the installation of modifying apparatus. Backing up this requirement may be a threat of no restriction, no guarantee against breakdown. System operators, in turn, are looking to switchgear engineers to get them out of their troubles by reducing switchgear over-voltages, especially in the highest ranges. How the balance will be struck remains at present, anyone's guess.

SUPPRESSION IN EXPORTS

BRITAIN is not alone in attempting to control by legislation interference with radio and television caused by domestic electrical appliances. In many other countries, laws are being drawn up or voluntary standards agreed, and similar problems of definition, measurement and technique are arising in every case. Here is a field which by its newness and its strictly technical nature is ideally suited to international standardisation, and it is encouraging that notable progress towards this aim has been made in recent months. The need for such agreement is the more imperative because if anti-interference legislation becomes really widespread, and every country goes its own way, the export of electrical appliances is going to be appreciably complicated. This is the more so because the problem is not merely one of performance alone; it is a complex of obtaining satisfactory suppression with a satisfactory margin of safety, since suppression almost inevitably involves some potentially dangerous connection between live wire and frame. World-wide standardisation in this field can promote efficiency both in trading and in technology, and it is to be hoped that in this country, the Post-Master General will take care that regulations he approves under the Wireless Telegraphy Act will line up with present international recommendations.

Meteor



D.C. Network Analysers

Considerations in their Application and Design

By K. W. WARDROP, B.Sc.(Eng.), A.M.I.E.E., A.C.G.I.

INCREASING interest has been taken in designing and planning extensions to existing power systems, and preparing schemes for new systems, during the last decade. Power stations have increased in complexity and size, and many are now virtually a transmission system in themselves. In addition, capital has been in short supply so that only the most essential schemes could be constructed. These factors have made the study of power system networks and the analysis of their performance imperative for achieving the best design. Although network analysis is possible by calculation methods on paper for many simple systems, the stage is soon reached when such calculations become unduly tedious and time consuming. An alternative is to build a scale model of the project to test the design. Any model of an electrical network is known as a network analyser and, if the impedances are represented by resistance and the model energised with d.c. it is called a d.c. analyser. This article briefly surveys the application and design factors of such network models. Although they have been used for many years, they continue to occupy an important place in network design.

Fig. 1. Above is seen the d.c. network analyser installed at B.E.A., Bankside House

Applications

The solution of fault level and load flow problems forms the major part of network analysis on most power systems. The fault level problem is to restrict the flow of fault current to a value which circuit-breakers can interrupt. Variation of connections, variation of impedance values of generators and transformers, and limiting reactors are used to control the situation, and the inevitable presence of old circuit-breakers with low rupturing current can cause real difficulty in securing a satisfactory solution.

The load flow problem is to evaluate the maximum value of load current in every circuit of the transmission system, with circuits out of commission if the design is to allow it, and so arrange the system that no circuit exceeds its current rating. The tripping out of one circuit as the direct consequence of another being disconnected for any reason must also be avoided. Very often the requirements for the reduction in fault current are in antithesis to those for a satisfactory flow of load current, and correlation of the two is by no means simple.

The prime purpose of a d.c. network analyser is to give a network designer the currents that will flow in his network under fault and load conditions. Its accuracy is highest if all impedances of the network have the same ratio of resistance to inductance, although it can be used with about 20% variation in this ratio using normal operation. Methods have been devised so that the analyser may be used even if this ratio is completely variable.* A load flow result for multivoltage network is shown in Fig. 3 together with the complete a.c. solution.

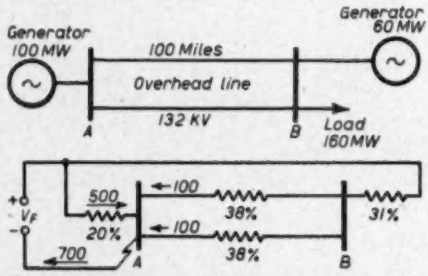


Fig. 2(a). Top, circuit diagram of simple system and, below, equivalent circuit for a fault study when a fault occurs at A

The voltages which occur in a power system may be calculated from the currents measured on a d.c. network analyser but no direct measurements of voltages can be made as on some other analysers. Measurement of power and phase angle cannot be made on the d.c. analyser, and consequently machine stability problems and maximum power transfer problems, for example, cannot be solved by its use. The whole range of high speed transient effects caused by lightning, etc., is also outside the scope of the analyser, as are such problems as the control of load and frequency. It is therefore particularly applicable to the study of power systems where the main difficulties lie in reducing the fault currents and controlling the flow of load currents. Despite these limitations however, the d.c. network analyser has the great advantage of being simpler and faster to operate than any other type.

All network analysers are representations of electrical networks and the results obtained cannot be more reliable than the data supplied to them. The equivalent circuit for each component of the transmission system has to be evaluated correctly and all values scaled to fit the range of the analyser units. In practice, the system will contain networks at different voltages and so basic values of voltage and current are chosen, a voltampere base, and all impedances in the network are expressed as percentages of an equivalent basic impedance. Thus an impedance Z ohms at voltage V is expressed as Z% impedance with a base value VA, by the formula

$$Z\% = \frac{Z \text{ ohms} \times VA \times 100}{V^2} = \frac{Z \text{ ohms} \times MVA \times 100}{kV^2}$$

if the voltage of the system is expressed in kV and the base quantity in MVA. This method is of great value for analyser working, as the base VA can be so chosen that the analyser units cover the range of the resultant percentage impedances in the best possible manner.

Circuit Elements

Overhead lines above 66 kV and all transformers, may be accurately represented on the d.c. analyser by their reactance only, which is the normal method of operation. For lower voltage networks, where the resistive component of the line impedances becomes significant, the impedances may be represented by resistance, or resistance may be used to represent the resistive component and capacitors substituted for the inductance,

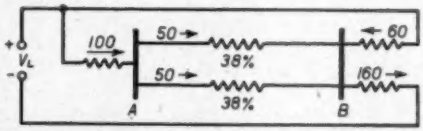


Fig. 2(b). Equivalent circuit for a load study of the circuit shown in Fig. 2(a)

operating the analyser on alternating current. For fault studies the equivalent impedance of the generator to the network busbar is represented, either its sub-transient or transient reactance plus generator transformer reactance. Alternatively, if the fault current from the generator for a fault on the generator busbars is known or calculated, this may

* *W. C. Hahn "Load studies on the D.C. Calculating Table," General Electric Review, Vol. 34, Nos. 7 and 8, July and August, 1931.*

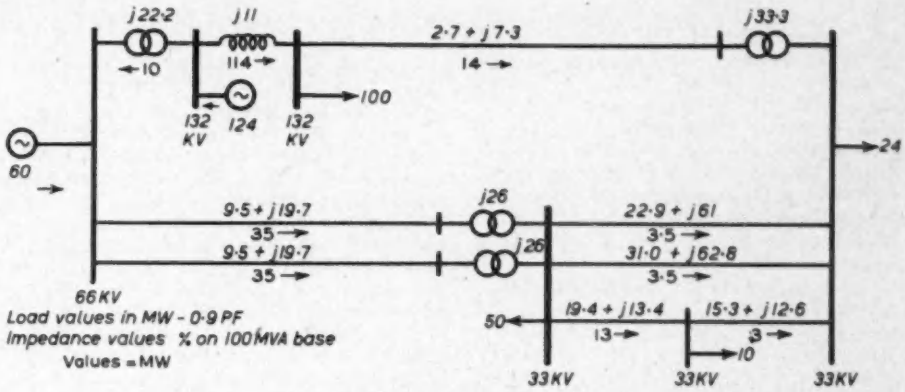


Fig. 3(a). Power system network for study. Italic figures above each line give system constants, while the figures below the lines give d.c. network analyser solution in terms of MW power flow

be represented by setting a current source on the analyser.

The equivalent circuit for a simple system is shown in Fig. 2 and the connections for a fault applied to busbar A are shown. The fault is applied to each busbar in turn and the fault currents flowing in each branch, and the total fault current, read directly. For load studies, each generator or load point in the network is represented by a current source or sink, as current is taken proportional to power on the d.c. analyser. Thus the equivalent impedances of the generator have no significance and the impedance used as the generator or load unit is purely a design feature of the analyser. Overhead lines, if all of equal construction, may be represented on the analyser by their lengths for load studies, as it is only the load sharing of the lines which is of interest. Once the load and generation at each busbar has been checked, the flows in all lines may be measured directly. The equivalent circuit for a load study is also shown in Fig. 2.

Design Details

The design of a d.c. network analyser has to satisfy many individual requirements of the user, but in common with all calculating machines, its reliability should be of the highest possible order. Normally closed spring contacts, when operating well below their designed voltage and frequency of use, are probably the most common source of failure. Contacts tend to be troublesome on low voltages, and duplication of all contacts which cannot be "designed out" of the equipment is advisable. The use of perman-

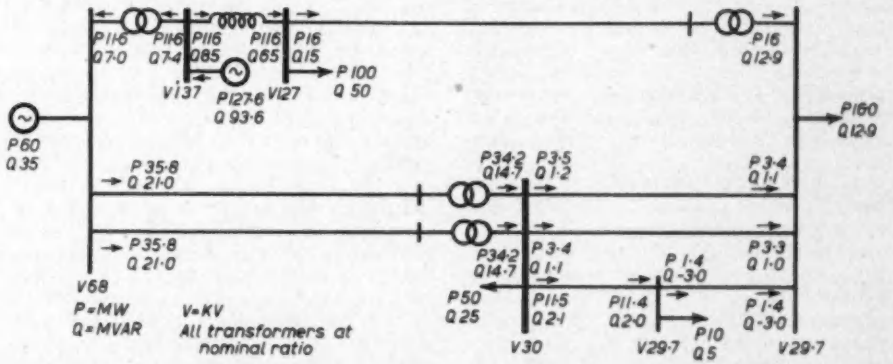


Fig. 3(b). The system shown in Fig. 3(a) is drawn here with values obtained in a complete a.c. solution shown. The close agreement between these and the d.c. analyser solution is apparent

ently wired shunts in every circuit for metering is advantageous, as the resistance of the circuit is not altered appreciably by the measuring instruments, and all contacts in series with the units for measuring are soldered joints. The detailed design of any analyser depends upon the need it is to satisfy, whether it be a geographical type, representing a particular power system, or universally capable of representing a range of power systems. Common to all designs however, is the problem of choosing the analyser voltage, current and resistor values, not forgetting the thermal rating of the resistors. If the analyser is to be used for fault studies, then the supply voltage V_F is given by the equation

$$V_F = I_F R_F \quad \ldots\ldots (1)$$

where I_F = amperes to represent 100% base fault current.

R_F = resistance to represent 100% base impedance on fault studies.

Thus only two of these variables can be chosen, the third being determined by equation (1). For load studies, the analyser values V_L – supply voltage, I_L – amperes to represent 100% load current and R_L – resistance to represent 100% base impedance on load studies may all be chosen independently, as only current sources are required for generators and loads, and the resistance of these bears no fixed relationship to the impedance of the network. It is desirable however, that the voltage across the generators and loads is a maximum and that across the network a minimum. This ensures that the generator and load currents are proportional to the conductance of the units representing them, and that the amount of adjustment required to obtain the correct currents is a minimum. If the variation of voltage across each generator or load unit on the network is limited to 1%, then the voltage drop across the network can be designed at 2% of V_L (this is the voltage between A and B in Fig. 2), as a maximum figure. If a maximum transmission phase angle—the difference in electrical angle between the phases of voltages at the extremities of the system—be taken as 30°, then there will be approximately 50% base voltage drop in the network. This voltage drop is $0{\cdot}5\ I_L R_L$, and is designed to be equal to $0{\cdot}02\ V_L$. Hence if all generator and load currents are to be proportional to their conductances to an accuracy of 1% for the majority of cases, then

$$V_L = 25\ I_L R_L \quad \ldots\ldots (2)$$

If the analyser is to be suitable for both fault and load studies, then it is necessary that equation (3) be satisfied.

$$\frac{V_L}{V_F} = \frac{25\ I_L R_L}{I_F R_F} \quad \ldots\ldots (3)$$

Thus if the same resistance values are used for the network components, i.e. $R_L = R_F$, then there must be a ratio of 25:1 in the supply voltages or the base currents for satisfactory operation. If the same currents are used for both studies, then the resistances and voltages must be adjusted according to equation (3) which is an equation showing the performance of the analyser. It may so happen that a ratio of 10:1 between the fault and load currents is usually obtained on the network to be modelled and this would be incorporated in the design to assist the metering. It is an advantage to have the generator and load impedances of the same order for both fault and load studies, so that one variable resistance can be used for both types of study, but this is but one item of design to be decided after the demands of equation (3) have been met.

Conclusions

A d.c. network analyser can be of great assistance in the design of power systems by supplying the answer to the technical problems of fault level and load flow distribution in a short time. A large scale d.c. network analyser is shown in Fig. 1. The author wishes to express his thanks to the British Electricity Authority for permission to publish this photograph.

N.C.B. Apprenticeships

ELECTRICAL apprentices are specially provided for in a new scheme which has been introduced by the National Coal Board. This provides for a co-ordinated course of progressive practical training and technical education lasting five years.

Apprentices are to be selected normally from boys under 17 from both within and without the industry, the intake being governed by the needs of the divisions as estimated at least yearly. Apprentices will be given general experience in all branches of engineering work during their first year, while later work will include installation and maintenance of all kinds of surface and underground electrical apparatus, training in cable jointing and in overhead line maintenance, and experience in the carrying out of statutory examinations and tests. All apprentices will proceed at least to the appropriate Ordinary National Certificate.

FRENCH POWER RESOURCES

Fuel Conservation a Vital Necessity

IT is occasionally salutory to look at the problems of fuel resources and utilisation in countries abroad. Such an opportunity was given last Thursday night when Mr. J. Couture, of Charbonnages de France, read a paper on French problems to the Institute of Fuel.

He began by surveying the present fuels native to the country. Petroleum production in Metropolitan France amounted to only 2% of the consumption and imports were 22 million metric tons. Only one deposit of natural gas was available, at St. Marcet, with an annual production of about 1,000 million cubic ft. The French coalfields produced 57·5 million tons of coal in 1952 and 18·5 million tons had to be imported. Most of the fields were old and now possessed limited reserves and only the Lorraine field was in full production. The Frenchman had only available to him one-tenth of the world average reserve of coal per person. Fortunately France was relatively well-endowed with hydro power, and this was being exploited to make up for other fuel deficiencies.

Electricity

After dealing with the coal and gas situations Mr. Couture turned to the electrical picture. The total consumption of electrical energy in France rose to 40·8 thousand million kWh in 1952 compared with 21×10^9 kWh in 1938, 27×10^9 in 1947 and $38{\cdot}3 \times 10^9$ in 1951. The year 1952 was a particularly favourable one hydraulically and $22{\cdot}4 \times 10^9$ units were generated by water power. In an average year this figure would be reduced to 20.4×10^9. Thus water power accounted for about 50% of the total.

The total potential of French hydro-electric power was about $80\text{-}90 \times 10^9$ kWh per year, but the plant already built was located in the most favourable situations and further exploitation would lead to increasing capital cost. The French economic situation however tended to favour the thermal stations with their comparatively low capital costs and higher running charges. Economies in the latter could be obtained by the use of large units—100 MW was now the rule.

An alternative power source was tidal energy and if a single-stage plant were built on the estuary of the Rance it would have an output of about 550 million kWh per year. Studies of a more grandiose scheme, which would however involve immense capital cost, were being carried out on the Channel between Cancale, Chausey Islands and Granville Point. This might produce between 10 and 15 thousand million units per year.

Utilisation of power had progressed continuously; a case in point was the electrification of the railways where 2,550 miles of main line had been converted and 90 miles of suburban lines in the Paris area. The annual saving due to electrification was about 3 million tons of coal.

An important point was the substitution of normal 50 c/s current at 20 kV for the 1,500 V d.c. used hitherto. All the technical difficulties had now been overcome, and this solution had now been decided on for present projects especially for the diagonal line from Valenciennes to Thionville.

Fuel Conservation

Domestically, the graded low-volatile coals were the only type in which a shortage still existed. To alleviate this, production of briquettes and ovoids had been stepped up, and the use of coke encouraged. In industry the problem of coal conservatism had been attacked by several organisations. The Steam Plant Owners' Association had a specialist staff to advise on heat utilisation; the Central Bureau for Rational Heating undertook the training of engineers and technicians as fuel-economy experts and there were several schools of fuel technology for instructional purposes. In addition many private undertakings had information and advisory services. There was however still much room for improvement, and a Consultative Committee for the Utilisation of Power (C.C.U.E.) had been established by Parliament in 1948. This body had to be consulted before a plant with a consumption of more than one million calories an hour was constructed, and further, every plant with a rating of more than 3,360 lb/hr must be technically examined every two years by an expert member of the C.C.U.E. Financial credits at comparatively low interest were also available for industrialists who wished to modernise their plant, and within some eighteen months over 1,000 million francs had been advanced to firms for this purpose.

Our readers' views ...

Multi-way Adaptors

I HAVE always regarded adaptors with abhorence, but have had to use them owing to the electrical layout of the flat that I live in. As the result of a shock I received the other day due to one, I now regard them with even greater suspicion.

The adaptor concerned plugs into a B.S. 15-amp 3-pin socket, and has itself one 15 amp socket at the top and one 5 amp socket on either side. Into one of the 5 amp sockets I had plugged a coffee percolator with a switch in the line. The plug on the percolator flex was correctly wired, and so was the 15 amp socket into which the adaptor was plugged. Knowing this, having checked it on a previous occasion, I made sure that the cord switch was off and began to remove the base of the percolator. Whilst doing so, one of my fingers touched a terminal that proved to be live. Puzzled, I tried the 5 amp plug into the socket on the other side of the adaptor, and with a test lamp this time showed the offending terminal was now dead.

These adaptors that bring about a reversal of polarity are a source of danger. I trust that by writing to you the danger will become more widely known to users, and that manufacturers of such adaptors will mend their ways.

Note: I hasten to add that I should, of course, have removed the plug.

John H. Quick
B.Sc.(Eng.), A.M.I.E.E.

BRISTOL, 8

Hospital Electrical Hazards

MR. P. JONES, in your issue of October 29, is certainly correct in suggesting that radioactive sources can be an additional precaution against build-up of static charges in operating theatres. They may be useful in special situations but not necessarily suitable for general use.

My main point was that semi-conductive rubber was the chief means of static suppression and it has brought with it additional hazards from mains electricity. One great difficulty is in connection with the lower resistance limit which cannot be relied upon to remain constant under practical conditions. For this reason I suggested the use of transformer-fed earth-free supply points for certain apparatus, being convinced that it is much more reliable to isolate the mains in this way, than to allow faulty apparatus to touch the patient, relying on his resistance to earth to protect him.

Owing to the tardy acceptance of earth-free circuits for operating theatres in this country I had expected to be criticised more on this point. However, I can only assume that there is more general agreement on this point than I had imagined.

Another point has occurred to me recently. The 100,000 ohm-240 volt conductive rubber circuit dissipates about ½ watt. B.S. 1938: 1953 stipulates that the material must be tested with an instrument dissipating "not more than" 2 watts. Under practical conditions conductive rubber may be expected to dissipate harmlessly 1 watt or more. These are admittedly low values, but we must have consistency and my suggestion is that B.S. 1938:1953 should read **not less than** 2 watts.

B. G. Palmer

ILFORD.

RESTRICTING RADIO INTERFERENCE

OF particular importance to the growing trade in electrical appliances are the results of the four-day international conference of the Special Committee on Radio Interference. Organised by the B.S.I., the conference sought agreement on three specific problems. These were, briefly, limits imposed on "man-made" interference; methods of measuring such interference, and safety considerations involved in the use of suppression devices.

In the first category, the committee recommended certain limits for noise voltages when measured at appliance terminals. Over the frequency range from 150 to 200 k/cs, the recommended limit is 1,500 microvolts, whilst for the ranges 200 to 285 kc/s and 525 to 1,605 kc/s, the limit is 1,000 microvolts. Appliances to which these limits apply are those rated up to 1 kW, whether for industrial, commercial or domestic use.

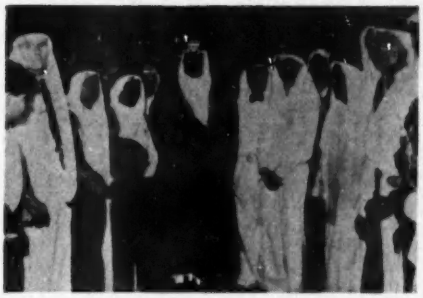
A considerable measure of agreement was also reached on the value of capacitance currents to earth at mains frequencies which could be accepted for domestic appliances without danger of shock to the user.

Power Supply in Mecca

Diesel powered station officially opened at Moslem Holy City

THE Holy City of Mecca now has its first public electricity supply. The power station was officially opened a few days ago by His Royal Highness the Crown Prince of Saudi Arabia, the ceremony being attended by Princes and Ambassadors from Moslem countries, in addition to a large crowd. It marked another stage in the progressive plans of King Ibn Saud who died on Monday. The station is equipped with four Mirrlees/Brush diesel generating sets of a total capacity of 3,740 kW, and later this will be increased to 10,000 kW. Until now there has been no general supply of electricity available for the 100,000 inhabitants of the Holy City,

H.R.H. Crown Prince Saud Ibn Abdul Aziz (who has now become King) photographed with members of Messrs. E. H. Juffali and the Brush Group



although a few people have their own plants.

The new power station is sited outside the walls of Mecca, and equipment within the city has been installed by Brush-trained engineers, since the city is not open to non-Moslems. Generation is at 11 kV, 50 cycles, 3 ph, the output being controlled by Brush 150 MVA totally enclosed, vertical isolation, horizontal drawout oil-immersed circuit-breakers. The contract for the power station was obtained by Brush Export Ltd., a subsidiary of the Brush Electrical Engineering Co. Ltd.

In the electrification of the city itself, the ring main transmission and distribution system has been provided by British Insulated

Callender's Cables Ltd., as sub-contractors. The o.h. transmission system comprises about 3,200 yds of double and 3,300 yds of single circuit 11 kV line, there being about 4,000 yds of 3 ph 4 wire overhead distribution line. From the power station, transmission is initially via 250 yds of 11 kV underground cable. The substations comprise outdoor type transformers of 300, 200 and 100 kVA capacity, stepping down to 415 V, distribution being by underground cable and o.h. line. Street lighting is controlled by automatic switches from the substations. The consulting engineers for the whole scheme were Preece, Cardew and Rider.

It may also be recalled that in June last we referred to plans for lighting the tomb of Mahomet, in Mecca, for the first time, using fluorescent lamps and other types of general floodlighting equipment being provided by the General Electric Co. Ltd. through their Saudi Arabian agents.

Passages from the Koran were read during the opening ceremonies

Insulation in H.V. Stations

Considerations Affecting Choice of Insulation Levels and Testing Requirements.—Part Two

By S. E. NEWMAN, A.C.G.I., A.M.I.E.E.*
and A. R. PARISH, B.Sc.(Eng.), A.M.I.E.E.

LIGHTNING surges on an overhead network may be caused by direct or indirect strokes. Most direct strokes to a phase conductor of a line will cause flashover on account of the high stroke current and "surge impedance" ($Z=\sqrt{L \div C}$) of the line. It should be noted that when a direct stroke causes flashover of one phase conductor of a line, overvoltages are induced in the other phase conductors which can result in operation of gaps or surge diverters.

Effect of Earth Wires

Shielding by overhead earth (ground) wires is used on transmission lines, and by earth wires or masts in outdoor substations, to protect against direct strokes. A "protective angle" (See Fig. 13) of 45 degrees represents average use for a single earth wire, while an angle of 60 degrees may be used where more than one wire is provided. As an indication, a single earth wire with a protective angle of 45 degrees has been estimated to give about 99.9% protection.

If a structure or earth wire receives a direct stroke it is raised to a high voltage above that of the phase conductors, which are substantially at earth potential relative to the stroke voltage, due to the voltage drop resulting from the passage of the surge current. This can result in a "back" flashover from the structure to conductor and gives rise to a steep wave front on the conductor. Earth wires must therefore be sufficiently spaced from phase conductors, and structures and line towers efficiently earthed. Where earth resistivity is high, buried earth wires may be used to reduce tower footing resistances.

While indirect strokes to earth near the line or substation induce transient overvoltages on phase conductors, flashover from this cause is in general confined to distribution systems of 33 kV and below.

Selection of Insulation Levels

For a given application the impulse "withstand" level (basic insulation level) of the station as a whole may be selected from one of the standard values given in Table I. This represents a minimum withstand level for the various items of equipment. Satisfactory co-ordination is then obtained if the protective devices prevent voltages in excess of this withstand level reaching equipment which may be damaged by overvoltages.

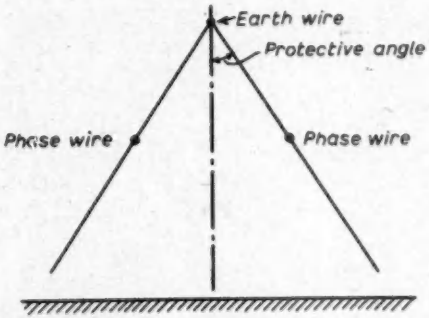


Fig. 13. Protective angle of earth wire

The selection of insulation level and co-ordination may require consideration of a number of factors.

Highest System Voltage

Insulation is more correctly related to the "highest system voltage" than to the nominal voltage of a system. The highest system voltage is defined as the highest phase/phase r.m.s. voltage which is sustained under

* Messrs. Newman and Parish are with the English Electric Co., Ltd.

normal operating conditions at any point on the system. It excludes voltage variation due to a fault condition or the sudden disconnection of large loads.

In B.S.77-1947 "Voltages for A.C. Transmission and Distribution Systems" a maximum operating voltage of 10% above nominal voltage is specified. The Swedish standards permit a maximum voltage 15% above the nominal while in the U.S.A. the difference is 5%. At present the International Electrotechnical Commission is attempting to produce a world-wide standard for system voltages; this will, for simplicity, be based on the "highest system voltage." Special consideration is necessary when the highest system voltage exceeds this maximum value.

Surge Diverter Rating

Surge diverters are rated on maximum R.M.S. line/earth voltage and standard surge diverter ratings take into account the permissible system-voltage variation referred to under the paragraph "Highest System Voltage." Selection is normally based on the assumption that in service the highest system voltage is only exceeded under very abnormal operating conditions and that the probability of a diverter operation coinciding with a voltage exceeding the highest system voltage is small. If, owing to special circumstances, abnormal system voltages are likely to be a frequent occurrence, and diverter operations are likely to take place during such conditions then it may be necessary to use a diverter of a higher voltage rating.

The selection of a surge diverter depends on whether the system is non-effectively or effectively earthed.

In the latter case the maximum line/earth voltage under fault conditions does not exceed 80% of the highest system voltage rating commonly known as "an 80% diverter" is used, permitting a reduced insulation level. The requirement of a maximum line/earth voltage not in excess of 80% of the highest system voltage is generally met in practice if, for all conditions of operation, the ratio of zero sequence reactance to positive sequence reactance is positive and less than three and the ratio of zero seq. resistance to positive seq. reactance is positive and less than one.

The protection given by a surge diverter is dependent on its discharge voltage characteristics (Fig. 12) and on the method of connection to the apparatus, usually a transformer, to be protected. To determine the protection level a margin above the diverter discharge voltage should be allowed to meet such factors as surge currents of a magnitude and steepness in excess of those prescribed. Wagner, Witzke, Beck and Teague† have proposed for high voltage substation application, a factor of 1·15 times the diverter voltage when discharging a 5,000 amp 10/20 wave and, unless the diverter is mounted directly on the transformer, an additional constant 30 kV to allow for voltage drop. The level so determined should not exceed the withstand level of the protected equipment.

The selection of 5,000 amp discharge current is based on statistical records of surge diverter lightning discharge currents in service. On occasions diverters may also operate on low current long time switching surges; while modern diverters meet normal service conditions, unnecessarily frequent operation is to be avoided.

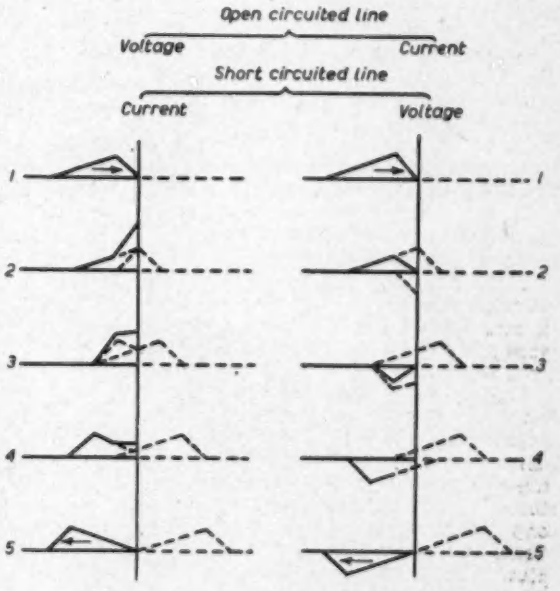


Fig. 14. Illustration of reflection of a travelling wave

Where equipment is connected directly to line without overhead earth wires, as for example at a fused tee-off point, high values of discharge currents through diverters are possible. In these circumstances co-ordination should be based on a diverter discharge current of 20 kA, but no allowance need be made for volt drop in the diverter lead since the diverter will be very close to the apparatus protected. In general such considerations will apply only below 66 kV since it is only at these voltages that overhead earth wires are commonly omitted.

Surge Diverter Location

A surge diverter serves to reduce the voltage to a minimum only directly across its terminals. Since the most costly items in a station are the power-transformers, which if damaged involve lengthy interruption of supply, the diverters should be located as near the transformers as practicable. Economic and layout considerations, however, may dictate the location of the diverters elsewhere in the station.

The waves of current and voltage resulting from a lightning stroke travel along an overhead line at approximately 1,000 feet per microsecond and in cables at about 600 feet per microsecond; in travelling they are attenuated and distorted, the wave fronts becoming less steep. If a wave encounters a change in surge impedance, reflection occurs, the reflected wave being equal to the wave transmitted beyond the point of discontinuity minus the incident wave. If a higher impedance is encountered the reflected voltage wave is of positive polarity with respect to the incident wave and the reflected current wave of negative polarity, while if a lower impedance is met the reflected voltage wave is negative and the reflected current wave is positive. In the extremes, at the open end of a long line the voltage is doubled and the current reduced to zero, while at a point of short-circuit the voltage is reduced to zero and the current doubled (Fig. 14).

When a voltage wave, entering a station reaches a surge diverter, the voltage at this point is reduced to that of the diverter discharge voltage and at the same time a negative reflected voltage wave travels back over the line. The reduced voltage wave travels onward from the diverter until it reaches the transformer where positive reflection takes place. The voltage at any point on either side of the diverter is, for any instant, obtained by superimposing the appropriate reflected and incident waves at that point; the nearer the point to the diverter the closer will the voltage approach that of the diverter.

It is seen that while a surge diverter gives protection in both directions, the greater the distance from the diverter the less effective is the protection, and as a simple approximate rule the following distances should not be exceeded:

TABLE II. APPROXIMATE PROTECTIVE DISTANCE OF SURGE DIVERTERS

Insulation Level appropriate to	Diverter Rating	Distance in feet, equal to
Non-effectively earthed system	80%	kV of system
Non-effectively earthed system	100%	kV of system divided by 2
Effectively earthed system	80%	kV of system divided by 2

Shielding

To avoid very steep fronted high current surges resulting from direct lightning strokes in the immediate vicinity of a station, the lines radiating from the station should be shielded, and to take advantage of the effect of attenuation and distortion, the earth wires should extend for at least a half mile. The effectiveness of such earth wires is dependent upon tower footing resistances, which should be kept as low as practicable. In localities where lightning is prevalent shielding should also be provided above the station itself.

Rod Gaps

In areas of low isoceraunic level (isoceraunic level=number of days per year on which thunder is heard), such as Great Britain, where the value is 15, rod gaps are commonly used in place of surge diverters for economy. Separate co-ordinating gaps mounted on or near the transformer may be provided or suitable rod gaps may be used on the transformer bushings. While it is claimed for the separate co-ordinating gap that it may be mounted to keep the arc flashover clear of all other equipment, a bushing gap has the advantage that the divergence between the positive and negative impulse sparkover voltages can be reduced by suitably locating the gap with respect to the bushing.

To provide a margin of safety, gaps used for co-ordination are normally set to have a 50% impulse flashover voltage of about 80% of the transformer impulse withstand level and it is common practice of British manufacturers on outdoor bushings used for trans-

formers, to provide rod gaps with settings in accordance with Table III.

It may sometimes be found desirable to use somewhat increased gap settings to avoid flashovers due to switching surges, but it should be appreciated that in so doing some loss of protection may result. In this connection it may be noted that on the 132 kV grid system, using transformers of 550 kV impulse level, the British Electricity Authority uses 26-inch co-ordinating gaps. Where surge diverters are used the gaps provided on the transformer bushings for co-ordinating purposes may be retained as "back-up" protection.

TABLE III. ROD GAP SETTINGS ON BUSHINGS

Impulse Withstand Level kV	Gap Setting in.
200	7
250	8
350	13
450	17
550	22
650	26
800	31·5
1,050	45

Gaps may also be provided on the switchgear in a station, for example, on circuit-breaker bushings and isolating switch insulators. These gaps have appreciably higher settings than the co-ordinating gaps and their primary purpose is to act as arcing horns to protect the insulators from damage from power arcs in the event of flashover. On the British Electricity Authority 132 kV grid system the arcing horns on the switchgear have 39-inch gap settings.

For the higher voltages rods or rings may also be provided as stress control to suppress corona.

Since flashover of a protective gap results in an earth fault which can only be cleared by de-energising the particular circuit, some consideration may be given to the limited application of surge diverters to selected circuits; a case in point might be a generator transformer circuit in a power station where a flashover might cause a major shut down.

Reduced Insulation Level

The cost of high voltage equipment is very considerable and of this cost insulation represents a large proportion. Any method by which the amount of insulation may be reduced is therefore of economic benefit.

The internally generated over-voltages on an effectively earthed system are considerably less than those on a system earthed through significant amounts of resistance or reactance. Consequently, if a system is effectively earthed the insulation may be somewhat reduced. Further, as previously explained, diverters of reduced voltage rating may be used on an effectively earthed system; these have a lower discharge voltage than diverters of full voltage rating and permit the use of a lower insulation level on the protected apparatus.

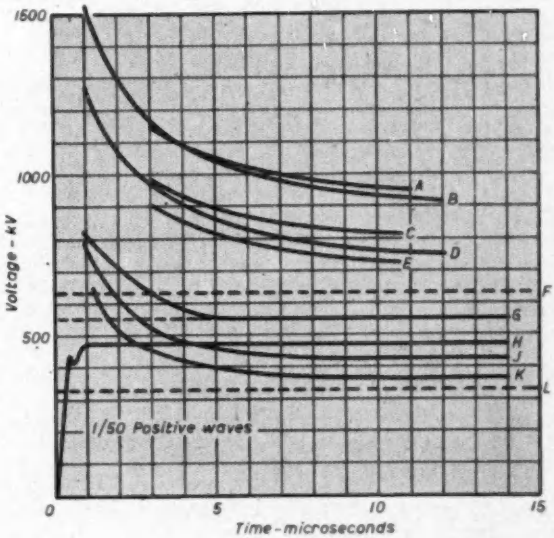


Fig. 15
INSULATION COORDINATION IN A 132 kV SUBSTATION

(A) Tension and suspension insulators—12 units. (B) Post insulators —5 units. (C) Tension and suspension insulators—10 units. (D) Post insulators—4 units. (E) Tension and suspension insulators—9 units. (F) 630 kV level. (G) Transformer withstand impulse level. (H) 121 kV surge diverter. (J) 26 inch rod gap. (K) 22 inch rod gap. (L) Peak value of three times phase neutral voltage

For transformers it is financially advantageous to reduce the insulation level of equipment to be used on system voltages of 88 kV and above; even below this voltage graded insulation may be desirable to reduce costs. For switchgear there is no advantage in the use of reduced insulation levels for system voltages below 110 kV and even at this voltage the advantage is very small; it is doubtful if the use of a reduced insulation level for circuit-breakers is really justified below 165 kV.

In the range from 88 kV to 165 kV it is common practice to use full insulation level on all apparatus apart from the transformers and to reduce the insulation level of the latter. The higher impulse level on the switchgear and busbars somewhat reduces the likelihood of failure on items of equipment common to a number of circuits; the transformer, at the lower impulse level, has the surge diverters or protective gaps mounted close to it and particularly intended to protect it, and so is the best protected item of equipment.

Where a reduced insulation level is used the usual practice is to adopt the next lower insulation level. For example, a 132 kV transformer with reduced insulation level would have a 550 kV impulse level, corresponding to 110 kV full insulation level, instead of 630 kV. (Table I).

At 165 kV and above it is the general practice on effectively earthed systems to use reduced insulation level on all apparatus, since at these high voltages it is possible to produce substantial savings on all items of equipment by reducing insulation requirements.

Station Clearances

While many individual pieces of apparatus are now impulse tested as a type test it is necessary, when designing a station, to have some ready method of deciding what air clearances are necessary between connections and structures, etc., which cannot, of course, be impulse tested. The electrodes bounding these clearance spaces may approximate to parallel bars, rod gaps or any other arbitrary configuration and so, in setting a clearance distance it may be necessary to consider the worst possible configuration but where the incidence of lightning is low reduced clearances (of the order of 85% to 90% of the values in Table IV) with consequently reduced costs for the substation, may be acceptable. The clearances given in Table IV have been used by a British manufacturer with satisfactory results, for some years.

TABLE IV. PHASE/EARTH CLEARANCES FOR BUSBARS AND CONNECTIONS

Impulse Withstand Level kV	Clearance to Earth in Air in.
190 to 200	16
260 to 275	22
330 to 350	30
450	39
550	48
630 to 650	54
730 to 750	66
800	69
890 to 900	75
1,050	84

Other Considerations

In choosing the insulation to be used on outdoor equipment two other factors are of importance; they are the effects of pollution and altitude.

So far no artificial methods of reproducing the effects of pollution have been found sufficiently satisfactory to form the basis of a test and the normal wet test with clean insulator surfaces is not a reliable indication of the performance of the insulator when dirty; the specification of the minimum creepage distance has proved the best solution. A creepage distance to earth of 0·67 in./kV of system voltage (e.g., 88 in. for a 132 kV system) has been found satisfactory for conditions of normal pollution, and 1 in./kV of system voltage where pollution is heavy. In the latter case at least half the specified creepage distance should be protected against rain at right angles to the axis of the insulator. These figures are in accordance with B.S. 116-1952.

Altitude

Switchgear and transformers to British Standards are suitable for use at altitudes not exceeding 3,300 feet above sea level.

The effect of high altitude is to lower the air flashover voltage compared with that at sea level, while puncture and oil flashover are unaffected. Recent British Standards specify that where the above altitude is exceeded the insulation level of parts in air shall be selected by increasing the standard impulse withstand voltage (and normal frequency wet withstand voltage) by 3·5% for each 1,000 feet in excess of 3,300 feet above sea level.

Similar consideration must be taken into account in the choice of air gap settings for use at high altitudes.

Standard surge diverters are designed for use at altitudes not exceeding 6,000 feet. The probability of use above this level is small

and in such an event reference should be made to the manufacturer of the particular diverter which it is proposed to use.

Example of Co-ordination

To bring together the various points mentioned in the preceding sections consideration will be given to the co-ordination of the insulation in a typical 132 kV station on an effectively earthed system having transformers of 550 kV impulse withstand level and the other apparatus of 630 kV level. It will be assumed that the altitude is below 3,300 feet and the pollution not unduly heavy. The positive volt/time curves for the various devices have been plotted in Fig. 15 to demonstrate the co-ordination which can be obtained; it is not normally necessary to plot curves in this way since a simple tabulation of the figures is usually adequate.

For the protection of the transformers and other equipment either a surge diverter or a rod gap may be used. Since this is an effectively earthed system an "80% diverter" would be used, that is one rated 121 kV. This particular diverter has a maximum discharge voltage of 444 kV when discharging a 5,000 amp surge, and making the calculation previously mentioned gives:

$$(1{\cdot}15 \times 444) + 30 = 540 \text{ kV}$$

This will be seen to be below the transformer withstand level of 550 kV assuming that the diverter is located within 60 feet or so of the transformer terminals.

Rod Gaps

If a rod gap is to be used for protection, Table III gives a value of 22 inches for a 550 kV impulse level transformer and in Fig. 15 it will be seen that this gap gives protection to the transformer even for waves as short as one microsecond. There is, however, only 25 kV margin between the 50% flashover value and the value of three times the normal line/neutral crest voltage which may be taken as the possible value of switching surges on an effectively earthed system. Thus an occasional flashover of the rod gap on an abnormal switching surge is possible. If the gap is increased to 26 inches to reduce this latter danger Fig. 15 shows that adequate protection is not afforded to the transformer for very steep waves. The choice between these two values is one requiring engineering judgment in individual cases and the consideration of other factors. For example, the presence of overhead earth wires on incoming lines will greatly reduce the probability of steep fronted waves reaching transformers, switchgear or other apparatus.

It will be seen that a four unit post of the type having the characteristics of Curve D of Fig. 15 will be adequate to meet the required impulse level of 630 kV. It has a creepage length of 119 inches, of which 85 inches is protected. Since we are considering an area where pollution is not serious, the four unit post will suffice. In an area of heavy pollution, where 132 inches creepage length is required, five units would be necessary to give adequate creepage distance even though four would meet impulse requirements.

Cap and Pin Insulators

A similar state of affairs exists in regard to tension and suspension strings of "cap and pin" insulators. From Curve E of Fig. 15 it will be seen that nine units will meet the impulse requirements but the creepage distance will only be 110 inches, of which 74 inches would be protected. To provide more margin for creepage requirements, ten units would probably be used for suspension strings, giving 122 inches total creepage length, 82 inches protected. For the tension strings, which having their axes more or less horizontal are more affected by rain, an additional one or two discs would be used.

The clearance to be used between live parts and earth in those parts of the station not subjected to impulse tests will be 54 inches in accordance with Table IV.

It has sometimes been suggested that a large number of levels should be used, with the highest level for busbar insulation grading down to the lowest level at the transformers, but in practical cases this is not economical since the various categories of equipment have different impulse characteristics, making close grading for waves of differing wave front impossible.

Acknowledgment

The authors wish to thank their colleagues for assistance in the preparation, and the Directors of the English Electric Co. Ltd., for permission to publish this article.

REFERENCES

† Wagner, C. F., Witzke, R. L., Beck, E., and Teague, W. L.: Power Apparatus and Systems, Dec. 1952, page 1,072.

Notes on Wiring

Due to unavoidable circumstances our usual fortnightly feature, *Notes on Wiring* by "MEGOHM," has had to be held over from this issue.

Parallel Running of Private Plant

B.E.A. Requirements for Industrial Generation

A SMALL booklet has recently been published by the British Electricity Authority, outlining some of the more important technical considerations underlying the running of private generating plant in parallel with the Grid system. Publication of the handbook follows the announcement made in the early part of the year that Electricity Boards would implement the Ridley Committee's recommendation that restrictive conditions in old contracts on the use and installation of private generating plant should be abandoned.

Type of Plant

The booklet deals with a.c. synchronous generators; a.c. asynchronous generators and d.c. generators. When the prime mover is a reciprocating type of machine, the cyclic variations will not in general prove an embarrassment either to the Board or to the consumer. They may sometimes be serious enough to preclude parallel operation.

Synchronous machines will require a competent staff at the consumer's premises to carry out the necessary synchronising operations and there should be sufficient knowledge and judgment available to ensure the right action being taken in emergency.

High voltage generators will invariably be operated as 3-phase 3-wire machines, and medium voltage generators must produce a practically sinuosoidal wave form. This will generally prohibit the use of small sets (under 100 kW) in parallel with the Grid network.

Compensated induction generators have an advantage over the uncompensated type as they do not draw magnetising currents from the mains. When the latter are used it may be necessary to introduce some form of p.f. improvement. Unless d.c. machines draw power from rotary or motor convertors, they cannot export to the Grid, although rectifier powered sets may be operated in parallel with it. In this case, high-frequency ripple is often produced which may cause some difficulty.

Power Factor

Considerable care must be taken over the control of p.f., as the Boards do not wish to be involved in supplying excessive quantities of wattless current. It is thus important that the p.f. at which the consumer operates his plant should be in accordance with the p.f. agreed with the Boards. Unless the consumer's operating conditions are fairly steady and consistent, some kind of recording instrument will be necessary to show that the agreed conditions are maintained.

The consumer's operating engineer will need to be in close touch with the Board Control Engineer to accept emergency instructions. Protective gear will also need to be installed but in many cases overload, earth leakage and reverse power relays will be sufficient. The earthing of large machines, which may at times be required to run independently of the Board's system will also require attention.

Earthing

The Electricity Supply Regulations, 1937, stipulate the conditions under which electrical systems shall be earthed and it will be necessary for the relevant provisions of these regulations to be complied with whenever privately owned generating plant is operated in parallel with an Area Board system. Normally, when a.c. high voltage synchronous generators are running in parallel with the Boards h.v. system, it is not permissible for the neutral point of the consumer's generator to be earthed. If however the generator be isolated from the system and required to take private load it will be necessary to earth the neutral of the machine either directly or through a resistance, which, in order to ensure satisfactory operation of protective gear, should match the resistance used to earth the Board's system. This will involve the installation of a neutral earthing switch which can be closed and opened by the operating staff. It will also be necessary to provide automatic closing of the switch to cope with certain fault conditions.

When a transformer is involved between the Board and the consumer, the earthing arrangement of the low tension side of the supply and the consumer's generator may be common but again in some cases difficulties may arise due to the circulation of third harmonic currents which may attain troublesome magnitude. The same considerations apply to the use of l.v. generators, but in this case it may be possible to eliminate the earthing resistance as many of the Board systems are solidly earthed.

Controlling Blast Furnace Air Supplies

Mercury-Arc Rectifier System Provides Flexible Supply

THE supply of air to blast furnaces is a factor of critical importance in the manufacture of iron and steel. The quantities of air needed are large, and may amount to three to four tons of air for every ton of iron produced, according to the grade of ore and nature of the burden. Further, as smelting is of necessity a continuous process and furnaces often operate for five or more years without shutting down, complete reliability of the equipment providing the air blast is essential because severe damage to the furnace may result from a failure in the air supply. Under normal operation, delivery of a constant quantity of air is required for a given charge, but controlled regulation of the air supply is necessary when starting up or shutting down the furnace, when tapping is taking place, and in cases of emergency.

Usually blast furnace air is supplied by a steam-turbine driven centrifugal blower designed for variable speed operation. However, where an adequate supply of electricity is available, the use of an electric drive becomes an attractive proposition. This must of necessity be variable-speed drive, and an interesting system using grid-controlled mercury arc rectifiers has recently been installed at the Rotherham Works of the Park Gate Iron and Steel Co. Ltd.

The two blowers, manufactured at G.E.C.'s Fraser and Chalmers Works, each deliver a maximum of 30,000 cu ft of free air per minute at an outlet pressure of 10 lb/sq in. gauge, or 25,000 cu ft/min at 15 lb/sq in. with atmospheric conditions of 30 in. Hg at 60° F. These blowers are of the multi-stage, single-flow, centrifugal uncooled type and have four 42 in. dia impellers.

Electrical Drive

Each blower is flexibly coupled through 4·42:1 speed-increasing gears of the double helical type to a 2,200 h.p. 770/580 r.p.m., d.c. motor. Two grid-controlled, steel-tank mercury-arc rectifiers provide the 750 V supplies to the motors, each rectifier being a twin-cylinder equipment rated at 1,740 kW. High-voltage supplies to the rectifiers are controlled by an 11 kV duplicate busbar, metalclad switchboard. One set of busbars is connected to the incoming 11 kV public supply, while the second set is fed from the works' generating station through a 3,900 kVA transformer which steps up the voltage from 3·3 kV. Each of the incoming feeders is equipped with a 400 amp triple-pole isolator, while the outgoing feeders to the rectifier transformers are fitted with spring-operated circuit-breakers.

The speeds of the blower motors are varied by controlling the voltage of the outputs from the rectifiers. It will be seen from the circuit diagram (on p. 904) that two phase-shifting transformers are connected in the grid circuit of the rectifier. Of these, the first is driven by a small geared motor which is controlled by "raise" and "lower" push buttons mounted

Above is a view of the two turbo blowers and left, the rectifier cubicles

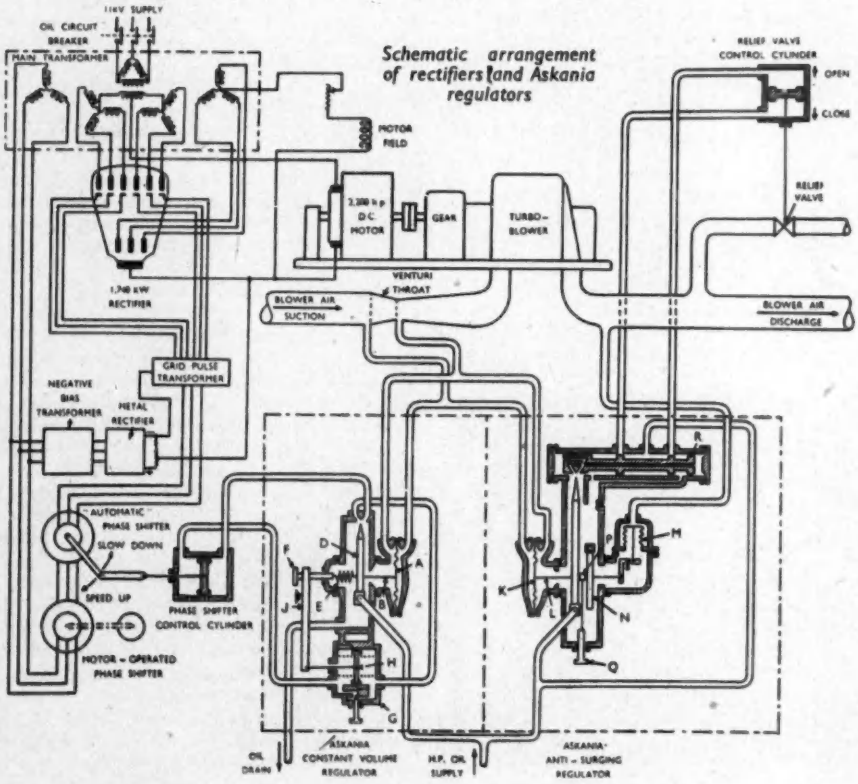
on the front of the grid control cubicle. The output of this unit is fed into the primary of the second phase-shifter which is automatically operated by an Askania constant volume regulator. The secondary winding of this second phase shifter is connected to the primary of the grid pulse transformer, the 6-phase output of which is fed to the grids of the rectifier.

During starting, the motor-operated phase shifter is used to increase the rectifier output, thereby raising the speed of the blower motor. As this speed increases the automatic phase shifter, operated by the Askania constant volume regulator, comes into play and eventually takes over complete control, varying the motor speed so as to maintain a constant volume of air to the furnace. A second Askania regulator is provided to prevent surging of the blower by operating a relief valve in the discharge main.

To start either blower, the appropriate circuit-breaker is first set to the busbars selected. The isolator and breaker are then closed to connect the supply to the main transformer from which the rectifier main anodes are energised. At the same time, the field supply transformer—the secondary winding of which is connected to the three field anodes—is energised from a tertiary winding on the main transformer. As the grid control gear is also supplied from this winding, the motor operated phase shifter can be brought into operation by pressing the "raise" push-button.

On shutting-down, the automatic phase shifter returns to its original low-voltage position, but the motor-driven unit remains in its maximum voltage position. This must be returned to low voltage before the rectifier can be re-ignited.

The equipment was installed by the General Electric Co. Ltd., and acknowledgment is due to the Park Gate Iron and Steel Co. Ltd., for permission to publish the above information.



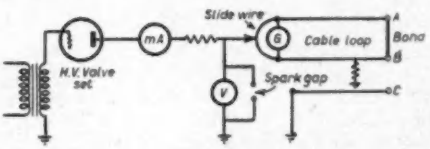
PROBLEMS AND PRACTICE in Engineering

Cable Fault Location and C.T.'s

TO prevent misconceptions developing in the minds of readers unaccustomed to the procedure described by Mr. Ogden in your issue dated 29th October, I feel obliged to emphasise the following aspects.

When conducting h.v. Murray loop tests to locate high resistance insulation faults between conductors and earth, conductors superfluous to requirements should be excluded from the test circuit and earthed to minimise the stress imposed on their insulation. Further, the voltage applied to the loop should never be permitted to exceed the site acceptance test value specified for the type and class of cable concerned, otherwise the dielectric generally may be strained. In most instances, owing to the age and possibly deteriorated condition of the cable, a lower maximum value is imperative.

As the regulation of typical test equipment is inherently poor, it is advisable to insert a voltmeter and spark gap in the test circuit to secure reasonably accurate measurements and to guard against excess pressure being applied inadvertently. The accompanying diagram illustrates the above features.



Here is shown the diagram illustrating circuit connections for conducting h.v. Murray loop tests on faulty cables

Any form of circuit-breaker isolation that occasions the open circuiting of current transformers is fundamentally unsound and should be discouraged. The advantage gained by providing for the continuity of secondary circuits under all service conditions is obvious but, notwithstanding such provision, it is unwise to neglect the precautionary step of shorting and earthing the secondaries.

Subject to the preceding comments and provided their designed working pressure is not less than that of the cable, the c.t.s may be left in circuit. This practice is frequently adopted during site acceptance tests where the switchgear design is such that the only practicable and comprehensive course is to treat the current transformers as cable components.—"*1066.*"

Trouble in the Shunt

IN reply to "R.A." whose contribution under the above heading appeared in the October 22nd issue, I would first point out that his sweeping suggestion is quite erroneous. I first dealt with paper-making machinery drives as far back as 1907, at a reliable motor manufacturer's and have designed many since.

It is possible by suitable control means to obtain virtually constant speed outputs from motors of the differential compound type. (A paper drive usually has a variable speed drive.) I think the only way in which such systems could be at all safe would be the addition, for example, of a "metadyne" or "amplidyne" quick-acting speed control winding, fully safeguarded against overspeed by reference fields and so on. This does not, however, alter my view that differential series windings are fundamentally unsound on a d.c. motor, and should be avoided wherever possible. Stability is the first requirement and then speed control can be obtained by an over-riding field control.

Consider, for example, armature reaction in a straightforward shunt wound motor. Primarily armature reaction, being displaced 90° from the main field axis, distorts the main field form. Subsequent saturation causes a field weakening of the main flux and a fall in back e.m.f. On increasing loads, especially above full load, the effect increases which results in a tendency for the machine to rise in speed. If the motor is compensated, i.e., has an embedded winding in the main poles with amp-turns distributed around the armature matching the armature amp-turns, then the distortion is relatively small.

It does not however become an economical proposition to fit compensating windings to motors below about 150 h.p. A motor which has a variable speed range is greatly affected by this phenomenon, as at top speed its field is relatively weak, its armature relatively strong, and distortion and field weakening with load more pronounced. At top speed

condition the commutating pole field will be over-strong, causing "early commutation." The effect of currents in the coils undergoing commutation then reacts on the main field in a direction to weaken the main field and hence results in further tendency to instability. Differential series coils all add to the above instability, especially on variable speed motors in the weak shunt field condition; that is why I say they are dangerous. It is desirable that electrical machines and apparatus fail to safety, like railway signalling systems, rather than the reverse.

The remarks by "R.A." on "some knowledge of the relative strengths and effects of main shunt and differential series would be sufficient to indicate why the motor does not start in the reverse direction with shunt unexcited" would infer that a very small series differential winding indeed was in mind. This could give small field with little torque when the shunt field was broken—the condition I had in mind and had suspected. Apart from series resistance in the armature circuit, the absence of back e.m.f. would have caused the current to have risen to alarming values whether differential or cumulative series windings were fitted, unless they were cumulative of some larger size.

It is possible to adjust a small differential series winding so that over a range from n.l. to f.l. (say) a practically constant speed can be obtained at one particular speed. This is a "knife edge" adjustment, however, and one, which, in service conditions, can become unreliable.

I note that several other regulators have failed and been rectified by the customer. This itself does not speak too well of the type of control apparatus supplied or its reliability. "Field breaking" in this way may result in permanent damage to the insulation of field coils or armatures due to high transient inductive voltages set up by such accidents. I would therefore advise fitting field protecting discharge resistances if not already in use.—*E.P.H.*

Contributions to this page dealing with specific items of interest to electrical engineers and maintenance men are welcome, and, if accepted, will be paid for at our standard rates. Problems of a practical nature to which a solution is required will also be considered. Contributions should be written on one side of the paper only and may be accompanied by sketches, which will be re-drawn for publication.

Measurements Section Discuss B.S. 2046

LAST week's discussion of standardised protective transformers by the Measurements Section of the I.E.E. was designed primarily to focus attention on the new British Standard B.S. 2046 "Protective Transformers" (reviewed elsewhere in this issue). As both manufacturer and user are affected by the new standard, the discussion was opened by two speakers, one putting the user's point of view, the other the manufacturer's.

From the point of view of the user, Mr. H. S. Petch, B.Sc. (Eng.), commenced by considering Appendix H of the Standard, in which is listed information required by manufacturers for the supply of protective transformers. For protective v.t.s no range of accuracy classes is provided, as for the simple forms of protection envisaged, permitted errors are likely to be satisfactory. As the Standard asks the user to state the type of protection required the manufacturer will recognise the need for special treatment.

The manufacturer has to be informed whether residual voltage windings are required, in addition to other information. Residual voltages, for two categories of v.t., have been standardised at 190 V, and there is then a possibility of a relay which takes 20 VA at 110 V (say) having the higher voltage impressed upon it for some time. As the relay will then be taking 60 VA, care must be taken to avoid over-heating.

Putting a manufacturer's point of view, Mr. J. G. Wellings pointed out that the standard applied only to transformers for overcurrent and/or earth-fault protection, directional or non-directional, using trip-coils or time-lag relays. A definition more clear than the expression "non-balanced protection" would be useful, as earth-fault protection and phase-fault stability definitely involve a condition of balance.

Discussing the term "saturation factor" (the factor by which rated primary current is multiplied to give an upper value of primary current beyond which limits of ratio error and exciting current do not apply) there is room for criticism when certain types of c.t. are considered. In these cases, such limits are reached not so much by core saturation but as a result of the length of magnetic circuit. The term has the value, however, of being concise, and of permitting further related terms. The wide range of standard burdens, accuracies and saturation values permits the selection of a rating nearer to service conditions than otherwise with resultant economy and greater convenience in accommodation in switchgear.

Ontario's Good Year

14% Increase in Commission's peak capacity

AN increase of 6·2% in units generated during the year ended December 31 last, is recorded in the annual report of the Hydro Electric Power Commission of Ontario. The total amount from all sources was 19,974 million units, of which 15,271 millions were provided by the 64 hydro electric and 8 fuel power stations owned or operated by the Commission, the remainder being purchased from outside concerns. Indicative of the increasing importance of the Commission fuel power stations is reflected in their production of 413·7 million units for commercial load purposes last year, compared with 104·1 million in 1951.

Power Development

Last year was noteworthy for the vigorous continuation of the Commission's power development programme. In all ten generators were put into operation at three major power stations. Seven of these were at the Otto Holden station on the Ottawa River, two were at the Richard L. Hearn steam station in Toronto and one was at the J. Clark Keith steam station at Windsor. As a result, the dependable peak capacity of the Commission's resources was increased by 14% to 3,353,350 kW in December last. There is, in fact, reasonable confidence, that existing sources of power, augmented by projects already programmed, will meet the requirements of the Commission's consumers until late in 1956 or early in 1957.

At the Sir Adam-Beck generating station No. 2, on the Niagara River, it was decided to proceed with a project of twelve 75,000 kW units instead of only seven sets as originally planned, and the first four of these are scheduled to be in operation next year. This project is particularly noteworthy for its two massive tunnels, both over 5 miles long and 45 ft in diameter which run under the city of Niagara and reach to a maximum depth of 330 ft below the surface of the ground. By the end of the year more than half of the excavation of No. 1 tunnel was finished and work had commenced on the second tunnel.

The Otto Holden hydro-electric station on the Ottawa River, was officially opened during the year covered by the report. By November last seven generators were operating, and the eighth followed early this year, bringing the station's capacity to 204 MW. Here, the switchyard contains four 230 kV, 800A, pneumatically operated, oil circuit-breakers with a rupturing capacity of 5,000 MVA. Each breaker has its own air compressor and storage tank.

Steam Plant

The Commission's largest steam power station, the Richard L. Hearn at Toronto, now has its 400 MW of installed capacity with the operation of the fourth Parsons set a few months ago. We have since had reports that the Commission is considering extending this station. The fourth English Electric generator at the J. Clark Keith steam station is expected to go into service this month, making the capacity of that station 264 MW. The Transmission Section also had a busy year, during the course of which 165 miles of 230 kV steel tower line, and 117 miles of 115 kV line were erected within the Southern Ontario system.

Turning to the rural electrification programme, excellent progress was recorded during the year, a further 24,931 new rural consumers being connected, bringing the total of such consumers to 343,537, who are served by 40,277 units of primary distribution line, of which 2,079 miles were added during the year.

Research

Among the many activities carried out by the Research and Testing organisation, reference is made to a new development in the treatment of insulating oils drawn from major equipment. In this, diatomaceous earth was used as a filter aid in clarifying used oil from circuit-breakers. A trial filtration of 400 gallons proved successful in removing colloidal carbon when ordinary methods had failed. A simple method of reconnection was also devised to convert 3 kVA 25 cycle transformers for operation at 5 kVA, 60 cycles, making possible substantial savings in the frequency standardisation programme.

On the financial side, operations of the Southern Ontario system resulted in a surplus of $25,163 as against a surplus of $65,093 for 1951, while the Northern Ontario system produced a surplus of $22,485 compared with a loss of $536,223 in the previous year.

Over-voltages on Supply Systems

International ideas on insulation levels considered by I.E.E.

IT is not very long ago that the only test for high-voltage insulation included in standard specifications was the application of an over-voltage at power frequency. As a result of increasing knowledge of the behaviour of power systems, and the characteristics of different types of insulation, there has been a marked change in recent years, and more special over-voltage tests are being written into national and international specifications. The assessment of over-voltages which lies behind these requirements is reviewed in a paper "The Co-ordination of Insulation of High Voltage Electrical Installations" which Mr. J. S. CLIFF, M.I.E.E. (The General Electric Co.) read before the I.E.E. last week.

Normal operating voltage of course remains of major importance. Under B.S.77, the highest value of this is 10% above the nominal value for a system. In America it is 5%; in Sweden 15%. Efforts are being made by the I.E.C. to standardise system voltages, using the highest voltage as a basis. Agreement has been reached by all European countries but for voltages of 52 kV and less the U.S.A. cannot accept European values.

On the occurrence of faults the method of neutral earthing becomes important, and in studies of insulation co-ordination two cases are recognised. In non-effectively earthed systems, the maximum voltage to earth during phase-earth faults exceeds 80% of phase-phase voltage. In effectively earthed systems, it does not. The normal percentage is, of course, 58%. The requirement for "effective earthing" on an earthed-neutral system is X_0/X_1 is less than 3 and R_0/X_1 is less than 1; where the suffixes indicate zero and positive phase sequence values. The condition is easier to obtain on systems for 66 kV and above.

Transient Over-voltages

The principal advance in knowledge has taken place in connection with transient over-voltages. These include those produced internally, by switching, etc., and those attributable to lightning. These over-voltages may be described by an "over-voltage factor," which is the ratio between peak value of over-voltage and the highest peak value of normal phase-neutral voltage. For switching surges on insulated neutral systems the factor is about 5, while for earthed-neutral systems it will seldom, if ever, exceed 3. When transformer magnetising currents are interrupted, a factor of 7 may be reached, though the maximum value seldom exceeds 4·5. By careful circuit-breaker design and with modern equipment it may be reduced to 3. When clearing a normal short-circuit, a circuit-breaker is unlikely to stress the insulation with an over-voltage factor greater than 3; for a high-voltage fuse, however, factors up to 4·5 must be expected.

The waveshapes of switching surges are naturally varied and complex, but records show that the rate of rise of voltage is much less steep than with lightning surges. Durations are from 20 to 3,000 microseconds.

Lightning produces extremely large over-voltages. The voltage is determined by the lightning current surge (from a few hundred amperes up to 160 kA) and the surge impedance of the line (about 450 ohm for a single conductor). For testing purposes an arbitrary representative wave-shape has to be adopted to represent the natural surge. In Europe it has been standardised as a 1/50-microsecond wave, and in the U.S.A. as a 1·5/40 wave.

Protection

The three forms of protection commonly used against transient over-voltages are rod-gaps, protector tubes, and surge-diverters. Rod-gaps, although the simplest and cheapest form of protection, have the disadvantages of supporting a power follow-through current after a flash-over, and of having a long time-lag for short duration impulses. This latter characteristic means that to provide adequate protection at short times, the minimum spark-over voltage must be set low, and frequent operation on switching over-voltages and minor lightning surges may result.

Protector tubes provide a rod-gap with better electrical characteristics, improving the spark-over voltage/time characteristic and extinguishing the follow-through current. They are mostly used for improving transmission line performance by preventing

flash-over of line insulation. They are not considered adequate protection for transformers except for distribution types rated at 15 kV or less.

Surge-diverters of the non-linear type give the highest degree of over-voltage protection, and are ideally suited for the protection of transformer installations. Their most important characteristic for insulation co-ordination work is the residual voltage, defined in terms of the peak voltage reached during the discharge of an impulse current having an arbitrarily chosen 10/20 microsecond waveshape. From data in service, the discharge current on 66 kV system surge-diverters exceeds 5 kA on only 4% of operations, and 10 kA on only 1%. The residual voltage for 5 kA is recommended for insulation co-ordination work. For lower-voltage systems, 20 kA is recommended. Surge-diverters are rated in terms of the highest r.m.s. voltage which can be safely applied across them during a discharge.

Selection of Insulation

The surge-diverter characteristics are an appropriate basis for determining the insulation requirements for apparatus exposed to lightning. For systems at 52 kV and under, the protection level can be the residual voltage at 20 kA. For voltages above 52 kV American practice is to base protection level on 1·5 (residual voltage at 5 kA) + 30 kV. I.E.C. recommended values in most higher voltage cases approximate to the voltages this formula gives.

Insulation on individual items of apparatus can be graded to encourage any breakdown to be an external one, in air, from phase to earth. In substations transformers are provided with a lower insulation level than switchgear, so that busbars are not involved in faults. At 132 kV, for example, the switchgear has an insulation level of 650 kV and the transformers a level of 550 kV.

DISCUSSION

Mr. F. J. Lane (B.E.A.) who opened the discussion referred to "this rather sticky problem of insulation co-ordination," and went on to discuss what engineers were trying to do in the matter. There was the need to specify a test which would ensure that the apparatus would meet all normal and all likely abnormal conditions. Next, means had to be found of diverting dangerous effects from apparatus, and thirdly, of ensuring that if flashover did occur, it came externally rather than internally, and at a less important part of the system.

The 50 c/s overvoltage test was mainly a check that nothing has gone badly wrong in manufacture. In this country pollution was the main working voltage problem, and creepage lengths were important. In connection with tests generally, many manufacturers were unwilling to disclose the margin between breakdown and withstand voltages, for fear that the figure would be used by the purchaser as a measure of quality.

Turning to the question of surge diverters, Mr. Lane recalled that present B.E.A. practice was dictated by engineering considerations. Surge diverters for 132 kV were used only in a few positions, such as across generator transformers. In general, the performance of the system would not justify the wider use of diverters. To protect the 500 or so Grid transformers, for instance, the cost would be about £1 million. During 1948-51 there were 164 lightning incidents, leading to 207 service interruptions. Surge diverters if installed would have effected a reduction of only about 10%, and they would have had little effect on transformer costs.

Mr. C. Winfield (Merz and McLellan) considered that more attention should be given to the problem of switching surges, and of the whole question of over-voltages produced by circuit-breaker operation. Omission from switchgear specifications of some limit on voltage peaks was a serious matter. At the 275 kV level, circuit-breaker effects could be as big a problem as lightning with regard to insulation. If switching surges could be avoided, it had been suggested, it might be possible to operate 275 kV lines at 380 kV. If switchgear engineers proved able to reduce switching surges, then something would have to be done about effects of lightning. Nowadays suitable surge diverters were available.

Mr. E. C. Rippon (C. A. Parsons) thought that insulation matters could be divided into two sections: that which was subject to contract, and "crystal gazing." Speaking of transformer insulation, he said that manufacturers had drafted a standard in which insulation was related to the highest system voltage. The standard would be based on the explicit assumption that system design and operation would be such that any surges reaching the transformer would be appreciably less than the voltage withstand level. This would be the basis of contracts. The use of 22in rod gaps on 132 kV systems would meet the requirements. If system engineers took greater risks, it would be a case of "no contract."

Mr. W. G. Hawley (B.I.C.C.) thought it gratifying that so much international agreement had been reached on this subject. He thought that surge diverters should always be connected directly across the apparatus they were protecting. On open lines, diverters should be rated to take the full 20 kA.

Mr. H. Leyburn (A. Reyrolle) suggested that the problem of insulation co-ordination could be attacked in two ways: by taking surge-diverters and working downwards, or by considering maximum switching over-voltages and working upwards. Strangely enough, from 33 to 275 kV

the two methods gave similar results. Over-voltage factors caused by switching could be as high as four. The kind of circuit had an effect, as well as the design of circuit-breaker.

He thought that a combination of rod gaps and reclosing circuit-breakers was better than the use of surge diverters, and the cost should be low.

Mr. G. B. HARPER (B.E.A.) did not think that reductions in insulation levels recommended by the I.E.C. up to 72·5 kV seemed really warranted. The higher number of lightning incidents experienced with lower voltage networks had to be borne in mind. With 132 kV system lightning incidents taken as unity, the figure for 33 kV was 4, and for 11 kV something like 40.

Mr. A. M. THOMAS (E.R.A.) speaking for himself and for Mr. D. Oakeshott of the B.E.A. Research Laboratories, thought it surprising that users of rod gaps found satisfactory the international insulation levels based on surge diverter.

Dr. GOLDE (E.R.A.) queried the author's statement that protector tubes were not suitable for transformer protection. He also suggested that the 20 kA level used for surge diverters on lower voltage lines followed from the short intervals at which they were installed in the U.S., and the corresponding greater risk of having to discharge full stroke current.

Mr. K. DANNENBERG (E.M.P. Electric) thought that h.v. fuses would usually have lower over-voltage factors than were quoted in the paper. Mr. J. MASON (E.R.A.) considered that more attention should be paid to processes of continual degradation of insulation.

The final speaker was Mr. D. M. CHERRY (B.E.A.) who reinforced Mr. Winfield's remarks on the need to limit switching over-voltages. He pointed out that with a star-delta transformer, what might be a tolerable over-voltage on the h.v. side might well over-stress the l.v. side.

The author in his reply stressed the need to remember that in this country the 132 kV system was closely interconnected, and that the isokeraunic level was lower than in many other lands.

Dr. BRAZIER, chairman of the Supply section, suggested in the course of his proposal of a vote of thanks, that there should be a partnership between manufacturer and user to explore how far insulation levels could be brought down without endangering the system.

BRITISH STANDARDS

Protective Transformers (Current and voltage transformers for protective purposes). *B.S.2046: 1953. Price 7s. 6d. net.* Since many requirements of protective transformers are similar to those of instrument transformers covered by B.S.81, this new Standard follows closely the lines of that standard, some of its clauses being incorporated unaltered. It should also be borne in mind that B.S.81 is likely to be revised in the near future, which will, in turn, involve a revised edition of this standard being issued simultaneously.

Dealing with transformers for over-current protection both of directional and non-directional types, and for earth-fault protection with time lag characteristics, the standard covers its ground in three sections. The first section is concerned with specifications which, in general, apply equally to both c.t.s and v.t.s. It includes a comprehensive clause of definitions, high voltage tests, and moreover, places supply systems into two different categories. Protective transformers and their testing are therefore conditioned by whatever system the unit is to be associated with.

Section two is devoted to c.t.s, specifying rated currents and burdens, accuracy classes and those tests which shall be executed by the manufacturer. The third section, concerned with v.t.s, covers rated voltages, transformation ratios and burdens, and also categorises transformers into 4 groups. Limits of ratio error and phase difference are specified for different categories.

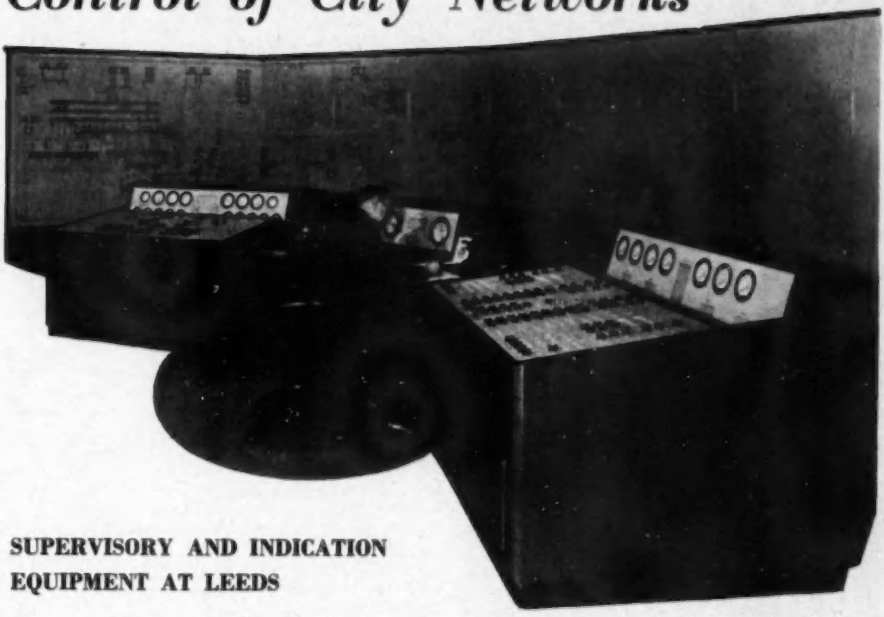
Finally a series of appendices deals with factors to be taken into account to determine transformer rating, and gives examples related to over-current rating. Of particular note is the list of information required by the manufacturer for the supply of transformers to this standard.

Metal Rectifiers for intrinsically safe signalling and control circuits. *B.S.2031:1953. Price 2s. 6d.* Prepared at the request of the Ministry of Fuel and Power (the recognised testing authority under the terms of B.S.1259) this standard covers rectifiers of a type used in certain intrinsically safe circuits either to provide unidirectional current or to suppress sparking when the circuit is broken, and hence whose characteristics and reliability are essential design features. Such units are those for use where the circuit voltage does not exceed 15 V a.c. (r.m.s.) or 25 V d.c. and current is below 1·6 A a.c. (r.m.s.) or 2·6 A d.c. Specified in this standard are rectifier construction; voltage, current and marking, together with routine and type tests.

Electroplated Coatings of nickel and chromium. *B.S.1224:1953. Price 2s. 6d. net.* As the 1945 edition of this standard did not meet fully requirements of the motor car industry, this revision has been issued. It has been extended to cover coatings on materials other than steel and copper, in particular zinc alloy, aluminium and aluminium alloys. Recognising the impossibility of specifying all factors affecting the performance of electroplated coating, the standard is concerned with essential qualities only, emphasis being given to minimum thickness and the effect of contour.

Dimensions of X-ray Films for Crystallography. *B.S.2030:1953. Price 2s. net.* As crystallographic needs cannot be met satisfactorily in B.S.1443, this new standard has been prepared covering sizes of film used in this equipment. It is hoped the Standard will also guide future design of such equipment and apparatus.

Control of City Networks



SUPERVISORY AND INDICATION EQUIPMENT AT LEEDS

RAPIDLY increasing loads in the city of Leeds have made it necessary to reinforce substantially the 6·6 kV distribution network and the first part of this reinforcement scheme was recently commissioned. This includes the establishment of two 33/6·6 kV substations in North Leeds, at West Park and Fir Tree Lane, fed from Kirkstall Power Station; and two similar substations in South Leeds, fed from a new 132/33 kV substation at Low Road.

In co-ordination with this scheme is a plan to operate the high-voltage distribution systems in the Yorkshire Electricity Board's area from several system control centres located at the main Grid supply substations. The first of these has been now established at Low Road to cater for the operation of the 6·6, 11, 33 and 66 kV systems.

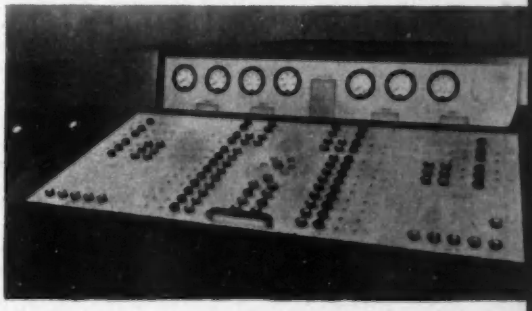
Control Equipment

A manually set wall diagram depicts the high voltage systems in the area of control, and several of the substations are remotely controlled from one wing of a desk. The other wing includes the control of the local switchgear. Initially ten remote substations will be supervised, but the panel is designed for a final installation covering 49 remote stations.

"Common panel" method of indication has been adopted whereby a single panel, incorporating the maximum number of each type of control or indication facility at any substation can be associated at will with any substation by operation of the appropriate selector key.

The whole of the equipment was manufactured and installed by Standard Telephones and Cables Ltd., in collaboration with the Yorkshire Electricity Board.

Close-up view of the common diagram control panel at right-hand end of the control desk seen above



overseas news

The Tariff on Motors

More tariff protection for electric motors manufactured in Canada is the present aim of the Canadian Electrical Manufacturers Association. At the moment detachable electric motors providing motive power in machinery of a kind not made in Canada, are subject to a 7·5% duty together with the machinery. Previously, because the motors were detachable and could be used elsewhere they carried a 22·5% duty. This discouraged the importation of machinery just for the motors and encouraged Canadian production of electric motors, it is stated. Now, with the major tariff protection gone the manufacturers are seeking a change in the tariff ruling which was introduced in the Budget resolutions last February as an amendment to the Customs Act. But because of the wide implications of the wording the amendment was withdrawn and the matter left with the Tariff Board who ruled that where the machine was sold as a single physical unit its components could not be separated for duty purposes. On an appeal from the Association the Revenue Dept. continued levying the higher duty on such motors until September when the application was rejected. Now the Canadian Electrical Manufacturers Association has taken the matter to the Finance Minister, Mr. Abbott.

Winnipeg's Problem

The general manager of the Winnipeg City hydro-electricity undertaking, Mr. H. L. Briggs, has now recommended that the policy of that organisation should be established independently of the Winnipeg Electric Co. He has urged this action following the recommendation of J. D. Woods and Gordon, consulting engineers, that there should be joint consideration with the Winnipeg Electric Co. as to whether or not the City hydro undertaking should continue to occupy the merchandising field.

Mr. H. L. Briggs has also recommended that consulting engineers be appointed to consider how the renovation or rebuilding of the Pointe du Bois power station should best be handled. This action the Public Utilities Committee has approved. The matter has arisen because much of the plant, which began operating in October, 1911, has reached the stage where a major programme of replacement and repair cannot be postponed. Mr. Briggs estimates that maintenance expenses over a period of from five to seven years may amount to about $3 million.

Electrification in Manitoba

Rural consumers in Manitoba used over 35 million units during September, an increase of 21% over the same month last year, the Manitoba Power Commission reports. This is a reflection of improvements to rural living which extensive electrification has brought about. September saw more progress made in the Commission's 1953 programme than in any month this year.

St. Lawrence Authority

An executive order has now been made by President Eisenhower designating the New York Power Authority as the official U.S. participant in the St. Lawrence Power project. But it is not yet possible to give the go ahead signal for full American participation in the power scheme over which controversy has raged for many months. A case is now pending before the U.S. Court of Appeals brought by various groups, objecting to the granting of such exclusive authority to the New York state alone. The Canadians have, of course, already announced that they would go ahead with development of the Seaway on their side of the river. This new executive order authorises the establishment of a U.S. section of the St. Lawrence River's joint board of engineers, which will be composed of two members, the Secretary of the Army and the Chairman of the Federal Power Commission.

Norway's Railways

In continuing its electrification programme, the Norwegian State Railways plan to electrify 62 miles of track a year at an estimated cost of £1,250,000 annually, H. Sveaas, the Electricity Director, announced in Bergen a few days ago. When the railways are completely electrified there will be a saving of £5 million a year in fuel costs.

100 years of Telegraphy

Like India, Sweden is this month celebrating its centenary of the establishment of the electric telegraph. In Sweden the first public line was opened between Stockholm and Uppsala. Special postage stamps have been issued.

New Greek Station

With construction well advanced, it is expected that the first of two 22,500 kW generators at the Agra hydro-electric station, north-west of Salonika, will go into operation early next year. The second unit should be running next May. This is one of four large power plants in Greece's electrification programme. It will supply current through Macedonia from Edessa to Kavalla and will later be interconnected with out power stations in the south. The plant is being supplied by the Italian Edison Co. under the reparations arrangement.

Bulk Supply for Calcutta

The power transmission system of the Damodar Valley Corporation is to be extended to Calcutta, Patna and Gaya. This was decided upon at the Inter-State conference at New Delhi recently. We earlier referred to a provisional agreement between the Damodar Valley Corporation and the Calcutta Electric Supply Corporation Ltd. for a bulk supply to the latter from the D.V.C.'s Bokaro power station, and we understand that final agreement has been reached in this scheme. The Calcutta undertaking will take about 40,000 kW in three years' time, and a maximum of 100,000 kW in 1960, we learn.

Construction Work

The Damodar Valley Corporation is seeking tenders in connection with the construction of the power station for the Maithon project on the Barakar River, about 150 miles north-west of Calcutta. Estimated value of the work is Rs. 41,80,000.

Development

The Minister of Health for Madhya Pradesh recently switched on a supply of electricity to Bhanadar from the Khaparkheda thermal power station. This is the 46th town to be electrified in the State. About 20 smaller towns have so far been connected to the 30,000 kW Kharparkheda power station which is operated by the State Electricity Board.

West Bengal Problem

Certain firms which were granted licences by the West Bengal Government in 1951 and 1952 to provide an electricity supply in a number of towns have so far made virtually no progress in this work, it is reported. Some Rs. 40 lakhs would be needed to electrify these towns, it is estimated, and it is believed that the firms' failure is largely due to the tightness of the money market and the limited profit allowed under the 1948 Act. The Federation of Electricity Undertakings in India has already drawn the attention of the Government to this restriction of development, but as yet there is, it seems, no official move to alter the position.

New Penang Station

Preliminary plans are being prepared for the construction of a new steam power station for the Penang Municipality, Malaya, and when this new station is in service the present plant at Prai will probably be closed down. The present indications are that the first stage will probably consist of two 10,000 kW generators, with the likelihood of duplication in the second stage. But to quickly assist in meeting the demand orders have already been placed with Harland and Wolff for two diesel generating sets, we understand. Consulting engineers for the new station are Preece, Cardew and Rider.

Another H.E. Scheme?

A proposal for a power development scheme involving the construction of a dam on the River Derwent about seven miles downstream from Ouse, was revealed recently by Mr. Knight, the Hydro Electric Commissioner of Tasmania. He was giving evidence to the Public Works Committee on the hydro-electric aspects of a proposed new bridge over the Derwent at Dunrobin. He suggested that to allow for the possibility of the power scheme it would be better to erect the bridge several feet higher than was proposed. There was no certainty that the hydro-electric scheme would be undertaken, as further investigations had yet to be made.

Acquisition?

Baulkham Hills Shire Council has asked the Sydney County Council, N.S.W. to take over its electricity undertaking. The County Council has referred the request to the Minister for Local Government, Mr. J. B. Renshaw, for consideration. The Baulkham Hills Council has operated its own undertaking since 1927, but has taken a bulk supply from the Sydney County Council.

Auckland's Deficit

For the first six months of the current financial year, the Auckland Electric Power Board, N.Z., has incurred a loss of £70,200, Mr. N. M. Speer, the general manager, has reported. He stressed that increased charges had only applied to 3½ months of the period, while the Board had paid high bulk purchase rates for the whole six months. Concerning earlier protests at the imposition of a service charge on domestic consumers, he said that if a similar charge could not be applied to commercial consumers also, the board would reconsider eliminating it altogether and reintroduce a two-charge rate. But the tariff would have to be recast to produce approximately the same return.

Gas Industry's Plight

Many of the gas undertakings in New Zealand are in such financial difficulties, despite Government subsidies, that they are being forced to close down. A recent instance is that of the Hastings Gas Works of the Napier Gas Co. But a difficulty has arisen from this trend—some of the electricity undertakings are not able to immediately provide a supply to the prospective consumers. Commenting on the matter recently, the Minister of Industries and Commerce, Mr. Watts, said that during the past two years the Government had made subsidy payments to the gas industry of over £1¼ millions, but it was intended to end on March 31, 1954. Last year legislation was enacted which gave the electric power boards the opportunity to acquire gas companies, and to continue to operate or close them down. But some gas consumers are complaining that insufficient provision is being made for an alternative fuel supply for them.

PERSONALITIES
IN THE INDUSTRY

Making a determined bid for increased trade in the Caribbean, Crompton Parkinson, Ltd. has sent its representative **Mr. Harold H. Spencer,** M.I.E.E., on an extensive commercial tour of the area. He left England by air last Friday, and plans to contact business men in Venezuela, Colombia, the Dominican Republic, Cuba, Mexico and throughout the Caribbean area. His visit is being made as the result of a report submitted to the Board of Trade by a U.K. Trade Mission which recommended an increase in British exports to this particular area.

Mr. H. H. Spencer

Eighty-one-year-old **Mr. Henry Rowe,** founder and director of H. Rowe and Co. Pty. Ltd., Melbourne, Australia, gave a dinner last week at the Savoy Hotel to twenty-five executives of the British electrical manufacturing companies that his company represents in Australia. Mr. Rowe started his career in 1890 as an assistant wireman and has built up an organisation which today gives nation-wide technical and commercial service over the whole of Australia for a number of British manufacturers. The company is now led by his son, **Mr. C. H. Rowe,** and his son-in-law, **Mr. C. A. Daley.** After-dinner speakers included **Mr. D. D. Walker,** joint managing director of Evershed and Vignoles Ltd., who proposed the health of Mr. Rowe and thanked him for the service that he has rendered to British exporters, and also **Mr. M. J. Gartside,** chairman and managing director of the Rheostatic Co. Ltd., who referred to the assistance that British manufacturers can give their overseas agents by paying regular visits to study local market conditions. In reply, Mr. Rowe expressed his company's appreciation of the support which had been given in early days by its English principals. **Mr. D. Dawson,** of Dawson Bros. (Shipping) Ltd., organised the dinner on behalf of Mr. Rowe and presented him with a gift from his guests to mark the occasion. Also among those present were representatives from Dorman Smith Ltd., Venner Ltd., Edison Swan Electric Co. Ltd., Berry's Electric Ltd., H. Tinsley and Co. Ltd., Geo. Bray and Co. Ltd., Tinsley (Industrial Instruments) Ltd., Brentford Transformers Ltd., British Physical Laboratories, and Bastian and Allen Ltd.

The Hoffmann Manufacturing Co. Ltd. announces impending changes in its London office staff. **Mr. P. Rhodes** is retiring from his position as London area manager on December 31, 1953, after 32 years' service with the company. He will not be leaving the company's service for some time in order that he can assist his successor in taking over his wider duties. **Mr. S. G. M. Shallard,** M.B.E., A.M.I.Mech.E., who has been his deputy as London area manager, will succeed Mr. Rhodes. Mr. Shallard had a wide engineering experience before joining the company, and during the past eight years has served in the firm's factories, at head office and on the outside staff.

Mr. F. M. Tomlinson, managing director of Pyrotenax Ltd., has left England on a six weeks' business tour of Ceylon, India, Australia and New Zealand.

From Bruce Peebles and Co., Ltd., we learn of the appointment of departmental managers, who will be responsible to the general manager. In the Rotating Plant Department the manager is now **Mr. V. P. Mackay,** F.A.M.E.M.E., M.I.E.S., Assoc. I.E.E., who was previously chief engineer of that department. In the Transformer Department, **Mr. R. W. Flux,** A.M.C.T., A.M.I.E.E. (formerly chief engineer there) becomes manager, and **Mr. D. H. Smith,** B.Sc.(Eng.), A.M.I.E.E., is now chief designer and deputy manager. For the Rectifier Department, the manager is **Mr. O. L. Robson,** M.B.E., B.Sc.(Eng.), M.I.E.E., who was previously chief rectifier designer.

Mr. V. P. Mackay

Mr. R. W. Flux

Mr. D. H. Smith

Mr. O. L. Robson

We hear from the South Eastern Electricity Board that, from a date to be fixed, **Mr. G. C. B. Everard,** the present manager of the Board's Horsham district, will take up the appointment of manager of its Hastings district, in succession to **Mr. J. Savage,** A.M.I.E.E. We understand that Mr. Savage will probably retire at the end of next March. Mr. Savage became borough electrical engineer and manager of the Hastings undertaking in 1945, after being deputy borough electrical engineer since 1927. Earlier he had served with the St. Helens and Paisley undertakings. Mr. Everard was chief engineer and manager of the Horsham U.D.C. electricity department prior to vesting day, having served with that undertaking since 1929. He had gained earlier experience with the Gloucester and Hereford undertakings.

Sir John Greaves has joined the board of Ransomes Sims and Jefferies. Sir John is managing director of Davey Paxman and Co. and a director of Ruston and Hornsby.

Mr. H. McNeil, formerly director and general manager of Babcock and Wilcox Ltd., has been appointed deputy managing director of the company, and **Mr. J. S. Robertson,** previously assistant general manager, is promoted to general manager.

Mr. John Pepper, establishment officer to the East Midland Electricity Board, has been elected vice-president of the National Association of Local Government Officers. He was first elected a member of Nalgo over 42 years ago.

At present deputy power station superintendent at Braehead generating station, South West Scotland Division of the B.E.A., **Mr. W. Rawnsley,** ASSOC.I.F., has been appointed station superintendent at the Division's Dalmarnock power station. Earlier he had been senior charge engineer at Stuart Street generating station, Manchester, and chief charge engineer at Mexborough power station, after gaining experience with the Halifax, Croydon and Southport undertakings.

Mr. F. S. Smith, late of J. and W. B. Smith and Lighting Trades Ltd., will shortly be free and would welcome enquiries from old friends, both buying and selling, at Nicholls Wood, Amersham Road, Chalfont St. Peter, Bucks.

To celebrate 50 years' connection with the electrical industry, **Mr. John Godden,** of John Godden (Stoke), Ltd., entertained his staff to a social evening at the Grand Hotel, Hanley, recently. During the course of this he was presented with a radiogram on behalf of the staff.

Ekco-Ensign Electric, Ltd. have appointed **Mr. C. T. Ives** as their representative covering part of the south-western and western postal districts of London.

Superintendent at Thorpe power station, Norwich for the past 18 years, **Mr. D. H. Brown,** A.M.I.E.E., was the recipient of a presentation made by Mr. W. N. C. Clinch, divisional controller of the Eastern Division of the B.E.A., to mark his recent retirement.

The English Electric Co., Ltd., has appointed **Miss Patricia Baxter** and **Miss Cynthia Shirley** to its demonstration staff.

Mr. E. Cooper, a director and general manager of A. C. Morrison (Engineers) Ltd. has left England to visit a number of the company's overseas agents. He is visiting the Lebanon, Iraq, Pakistan, India, Burma, Thailand, Malaya, and Indonesia.

OBITUARY

Mr. C. J. Sarjeant, who retired in 1949 from the position of manager of the Control Gear Engineering Department of the British Thomson-Houston Co., Ltd., died on November 3. Born in London, he was educated at St. Mary's Church Schools, Balham, and Battersea Polytechnic. He joined B.T.H. in 1911 as an assistant in the Test Department, but practical training was interrupted by service in the First World War. He rejoined the Test Department in 1919 and a few months later transferred to the Control Gear Engineering Department. In 1925 Mr. Sarjeant went to South Africa to supervise the final installation of the 3,000 V d.c. automatic substations of the South African Railway electrification scheme. He was appointed manager of Control Gear Engineering Department in 1947.

Mr. C. J. Sarjeant

Mr. A. D. Holder, who has been South Wales manager for Walsall Conduits Ltd. for the past 22 years, died on October 25.

Mr. F. Wilson, formerly of Adams and Co., electrical fittings manufacturers, died on November 7, aged 83.

Mr. Frank H. Corson, M.INST.C.E., M.I.E.E., who died on November 6, aged 76, was for 35 years city electrical engineer of the Gloucester Corporation electricity undertaking, retiring from that position in 1944. His apprenticeship was served with Musgrave and Co., and he was afterwards with the Edison Swan Electric Co. before joining the Bolton electricity undertaking. He then joined the Blackburn electricity department as generating station superintendent, becoming chief assistant engineer before going to Gloucester as city electrical engineer in 1909. There he was responsible for the construction of the city's generating station which was built by arrangement with the Central Electricity Board and officially opened in September, 1943.

NEW LITERATURE

Principles of Alternating-Current Machinery

by R. R. Lawrence, rev. by H. E. Richards

THIS fourth edition is a major revision, both in order of presentation and in subject matter. In particular, chapters on polyphase auto-transformer connections and the mercury arc rectifier have been added. Most notable of changes in presentation is the placing of the sections on transformers at the start, to conform to general practice. Throughout the book, the previously used c.g.s. units have been replaced by m.k.s. or English practical units in accordance with the modern tendency.

Intended primarily for senior electrical engineering students, the book as a whole discusses only the more important types of a.c. machines, notably static transformers, rotating field alternators, and synchronous and polyphase induction motors. Less attention is paid to single phase induction, series and repulsion motors, synchronous converters and m.a. rectifiers. Of those machines treated in detail, construction and operation receive close examination, mathematical and analytical treatment being freely used where this becomes advantageous. Fourth Edition, published by McGraw-Hill, 623 pages, 9 in. by 9 in. Price 60s.

Principles of Electronics

by H. Buckingham, PH.D., M.SC. A.M.I.E.E., *and E. M. Price*, M.SC. (Tech.)

ASSUMING that the reader of this subject is familiar with general a.c. and d.c. current theory, this book concerns itself directly with basic principles related to the study of this rapidly developing science of electronic engineering. Applications of electronic devices moreover receive scant attention, but the book, clear in exposition and relying on physical rather than mathematical explanations, makes a useful contribution for those following general electrical engineering courses, particularly the power engineer. Its first five chapters are devoted to basic facts and theory. Common electronic devices and their operating principle are then described, whilst concluding chapters discuss some applications of electronic methods and devices to the engineering and industrial problems. Published (as part of their Electrical Series) by Cleaver-Hume. 336 pages, 7½ in. by 4¾ in. Price 15s.

The Welding Review Year Book, 1953

ed. by J. V. Brittain, B.SC., A.M.I.E.E., M.I.I.A.

IN this useful book are found guides for almost every type of welding technique in present day use. Each welding process, from conventional arc welding to oxy-acetylene welding, is described briefly, whilst additional chapters describe suitable equipment or special techniques. The book opens with general topics related to welding, progressing to an informative discussion of new plant and equipment introduced during the previous year. Welding processes are then considered, together with other processes utilising welding techniques, with emphasis on large resistance welding, automatic arc welding and stud welding. A useful guide to the weldability of most metals, and a comprehensive buyers' guide brings it to a close. Published by Engineering Trades Ltd., 26 Holborn Viaduct, E.C.1. 308 pages, 7½ in. by 4¾ in. Price 9s. 6d. (10s. post free).

BOOKS RECEIVED

Principles and Practice of Radar, by H. E. Penrose and R. S. H. Boulding. Revision, condensing earlier chapters, amplifying later sections of practical value to students, operators and technicians. Fourth edition, published by Newnes, 795 pages, 8½ in. by 5½ in. Price 50s.

Natural and Synthetic Fibres. Completes a series of 18 booklets prepared to cover P.O.A. final examination subject "Raw Materials (Economic and Geographical Survey)." Published by Purchasing Officers' Association, Wardrobe Court, 164a Queen Victoria Street, E.C.4, 39 pages, 8½ in. by 5½ in. Price 3s. 6d.

The Price of Fuel, by T. M. D. Little. Economic theory applied to coal, gas and electricity tariffs. Published by Geoffrey Cumberlege and the Clarendon Press, Oxford. 197 pages, 8½ in. by 5½ in. Price 12s. 6d.

Education and Training in the Field of Management. Survey describing courses available at all levels providing education and training for management. Published by the British Institute of Management, Management House, 8 Hill Street, W.1. 200 pages, 9 in. by 6 in. Price 7s. 6d.

Transport Costing. First of a series on cost accountancy affecting local and public authorities. Compiled jointly by the Institute of Municipal Treasurers and Accountants and the Institute of Cost and Works Accountants and published for them by Gee and Co. (Publishers) Ltd., 27 Basinghall St., E.C.2, 23 pages, 8½ in. by 5½ in. Price 2s. 6d. post free.

Microwave Lenses, by J. Brown. One of the publishers series of monographs on physical subjects, designed for science graduates. Published by Methuen, 125 pages. 6½ in. by 4 in. Price 8s. 6d.

Plastics Progress 1953, edited by P. Morgan. Based on papers presented at the British Plastics Convention, 1953, with discussions. Published by Iliffe. 439 pages, 9½ in. by 6 in. Price 50s.

Principles of Electricity in M.K.S. Units, by A. Morley and E. Hughes. Covers 1st and 2nd years of O.N.C. course, and apart from conversion table makes no reference to c.g.s. units. Published by Longmans, Green and Co. 364 pages, 7½ in. by 4¾ in. Price 10s. 6d.

Safeguards for Ionising Radiations in Industry

A RECENT H.M.S.O. publication concerned with precautions for the use of ionising radiations in industry combines in one volume a useful guide for safeguards in a wide variety of application. One such specialised field of use lies in the elimination of static electricity, using equipment with which intense local ionisation of the air is built up around those parts of machine where static is being generated.

With eliminators using strontium 90 (+ yttrium 90) and thallium 204, from which only beta radiation is emitted, protection can be afforded by the use of sheets of "Perspex" or similar material 9 mm and 3 mm thick respectively. Screens fabricated from 5 mm and 2 mm glass, or 1 mm and 0·5 mm sheets of almost any common metal will also suffice. Where radium based eliminators are used, however, the emission of penetrating gamma rays renders protection more difficult, and lead shielding may be necessary to protect operatives in the vicinity of such eliminators.

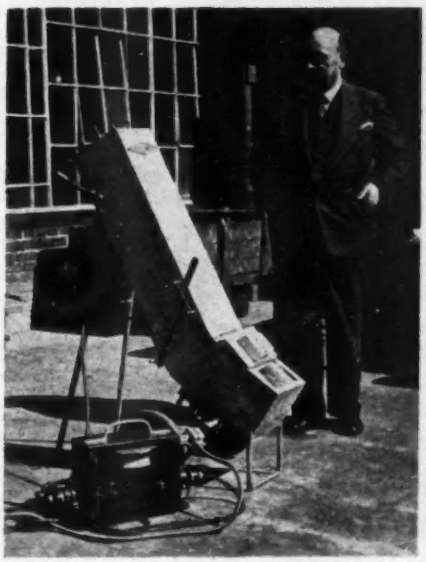
Before installation or removal, eliminators should be screened with the manufacturers' guard bars. If several units are used together, their mounting on to a single base plate to which is attached a single guard bar, is advised. Interlocking arrangements ensuring automatic screening of an eliminator when maintenance work is being conducted near it, is a further safeguard. Construction of each unit should ensure that all radioactive material is sealed in to avoid contamination and painted a distinguishing colour to call attention to its potential danger.

Published for the Factory Department, Ministry of Labour and National Service, by H.M. Stationery Office, the report (Factory Form 342, June 1953) is available, price 2s.

HEATING ALUMINIUM RIVETS

THE jointing of aluminium sheets by aluminium alloy rivets is a well proven and satisfactory technique. Up to the present however it has been the general practice to drive these rivets cold, due mainly to the narrow temperature range allowed.

Trials have however shown that the time taken to drive heated aluminium alloy rivets is only half of that required to drive them cold. Further, when rivets of comparatively large size need to be driven, real advantages appear. A $\frac{1}{2}$ in. dia. rivet in aluminium-magnesium alloy N6 can, for example, be fairly readily hot-driven under workshop conditions—a quite difficult matter where cold-driving is concerned. Only certain non-heat-treated alloys are at present recommended for hot driving.



The furnace and its control equipment

A portable aluminium rivet furnace, designed with the foregoing considerations in mind, has now become available from Messrs. R. M. Catterson-Smith Ltd., Adams Bridge Works, Exhibition Grounds, Wembley, Middlesex. This unit was developed under the auspices of the Aluminium Development Association and is suitable for rivets of $\frac{1}{4}$ to $\frac{3}{4}$ in. dia. up to 3 in. long. The output of the furnace is 2-5 per minute according to size of rivet. Electrical input is under 15 amps and furnace weight is about 200 lb. The furnace is thermostatically controlled.

The rivets are fed one by one, into a tube at the top of the furnace and are heated as they pass through it. They are then dropped into a heated tray at the bottom by a simple hand mechanism, and are withdrawn, as required, from the tray through a hinged lid.

PLASTICS AND TROPICALISATION

Effects of Exposure on Polythene Samples

AT the instance of the Ministry of Supply British Plastics Federation sub-panel of the Inter-Services Plastics panel, evaluation of the effect of climatic conditions in the tropics on some properties of plastics is being carried out as a long-term policy. The latest report on these tests "Reports on Plastics in the Tropics, No. 2, Polythene" has been recently published by the Ministry of Supply and is available from H.M.S.O., price 2s.

Test Samples

The tests on polythene are regarded as particularly important, as the material is specified for a variety of high frequency electrical applications because of its low power factor and permittivity. It is also suitable for such purposes as packaging and water-piping because of its ductility and inertness.

The report shows that the inclusion of 0·1% of carbon black in polythene provides a considerable measure of protection against the deterioration of properties caused by light. Two grades of polythene, each sample of which contained antioxidant (0·1% of "Noxol" D.C.P.) but which were presented both with and without the inclusion of carbon black (0·1% "Kosmos" B), were exposed for periods of three, six and twelve months to fair sets of conditions—jungle undergrowth, jungle clearing, semi-desert and tropical surf beach—in Nigeria.

Conclusions of the report are that polythene is resistant to the moisture of tropical climate as represented mainly by jungle exposure sites, but is susceptible to the actinic effects of the tropical sun, preponderant on the beach and desert exposure sites. These effects are greatly reduced by carbon black (which is specifically recommended for this purpose by the makers of polythene).

Effects of Exposure

The main results of the continued sun exposure were:—an increase in "brittleness," exemplified by loss of flexibility and extensibility, and a rise in cold bend temperature and the appearance of surface cracks. Electrically, there was a thirty-fold rise of power factor in the absence of carbon black, or a ten-fold rise in the presence of carbon black, under the worst conditions of the trials.

As ductility and low power factor were the foremost properties leading to the selection of polythene in preference to any other materials, the report concludes that it would be necessary either to be satisfied with a limited service life in direct sunlight, or to provide additional protection for the material.

There was no difference in the behaviour of the two grades on trial; "Alkathene" grade 7—a medium extrusion grade of polythene—and grade 20—a softer material.

Other Factors

Biologically, there was no indication that fungal growths had attacked the polythene itself, but physically there was a general progressive shrinkage of all specimens although this shrinkage was least at the jungle site. Weight loss was also apparent in all samples with the exception of the batches at the jungle clearing site. Exposure on the semi-desert and beach sites ultimately led to a considerable reduction in elongation, particularly in the absence of carbon black.

The electrical properties of permittivity and power factor remained practically unaffected in all batches in the jungle undergrowth and carbon black prevented severe deterioration in the jungle clearing. The untreated samples in this location, however, showed severe worsening of these functions. The protection afforded by carbon black was not sufficient for specimens exposed for over six months at the semi-desert or beach sites.

Finally, the small concentration of carbon black used, afforded partial protection against embrittlement, which, however, was nearly exhausted after one year on the sunny sites. Unprotected material has a useful life as regards brittleness of six months or less in the desert, less than a year on the surf beach and about one year in the jungle clearing.

Commenting on the Report, Dr. W. E. de B. Diamond, Director of the British Plastics Federation, said: "These are the first reliable results obtained about polythene, because in spite of the development of tropical chambers for testing it is difficult to simulate exact conditions. The tests . . . are essentially long term and will no doubt be continued at intervals as new and improved materials come into use. There is a large number of plastic materials already undergoing test."

The BUYER'S *Column*

G.E.C. to Market Super Speed Kettle

DUE to reach the shops next month is a new super-speed boiling kettle built of corrosion-resistant aluminium which will boil 3 pints of water from 60° F in 5½ minutes.

This introduction by the GENERAL ELECTRIC CO. LTD., Magnet House, Kingsway, W.C.2, has a standard loading of 2 kW and is supplied in 3 pint and 5 pint sizes. It has an easy to grip Bakelite handle and incorporates an automatic safety cutout in case of boiling dry. The kettle has three heat insulated feet cold pressure welded to the kettle by a process developed in the G.E.C. research laboratories. There is said to be no danger of the feet being knocked off. Supplied with 4 ft of flexible cable and an appliance connector, the kettle in the 3 pint size (D5183) is priced £3 and in the 5 pint size (D5185) at £3 5s. It can be supplied with loadings of 1 or 1½ kW without extra charge and in a chromium-plated finish if desired.

The new super speed kettle is corrosion resistant

New Grubb Products

NEW lines introduced by the GRUBB ENGINEERING CO., LTD., Mary Street, Birmingham 12, are tubular heaters in a variety of sizes and non-withdrawable element immersion heaters.

The tubular heaters which are finished in burnished bronze are fitted with ¼ in. conduit entry and cable bush and are available for 200/220 V - 230/250 V mains, and can be had in single or double, three- or four-tier types in lengths from 2 ft to 16 ft (rated 60 W per foot). Prices range from £1 8s. 11d. (inc. tax) for a single tier 2 ft heater to £8 19s. 6d. for a 10 ft double-tier unit. Other prices on application. Room thermostats are available (tax free) 58/10d.

The non-withdrawable element immersion heaters are available in 2 or 3 kW (240 V) types in 12-24 in. lengths (2 kW) and 18-36 in. (3 kW) lengths. The former are fitted with 1¼ in. B.S.P.T. heads and one listed at £2 12s. 6d. plus purchase tax £1 8s. 9d., whilst the 3 kW models have 2¼ in. B.S.P.T. heads and are priced £3 14s. 6d. plus £2 0s. 9d. purchase tax. Thermostatically controlled types are 33s. extra. Both appliances are guaranteed for twelve months.

The company now markets a range of electric fires (1 kW and 2 kW) which are fitted with safety grilles in chromium and are finished in cream and hammered effect in eau-de-nil, silver or gilt. Prices are £3 2s. 6d. plus £1 14s. 3d. tax (1,000 W) and £3 10s. 6d. plus £1 18s. 3d. tax (2,000 W).

The well known Grubb range of oil-filled radiators has been extended and now includes from 500 W to 2 kW models which can be had with bakelite wheel castors if desired.

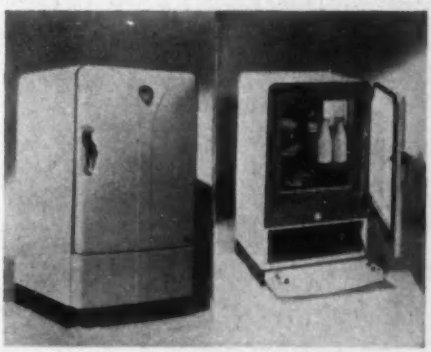
Floor Standing "Astral" Refrigerator

WELL known as makers of an efficient inexpensive table model refrigerator, ASTRAL EQUIPMENT LTD., 96 Buchanan Street, Glasgow, C.1, are soon to introduce a floor-standing model.

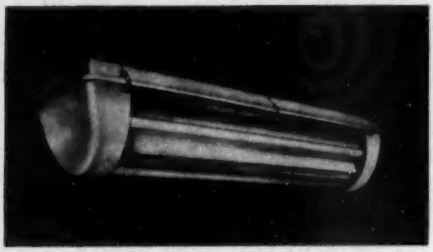
Standing 3 ft high by 1 ft 8½ in. wide by 1 ft. 9½ in. deep this new absorption type model has an internal capacity of 1·5 cu ft. Its outer casing is constructed of zinc protected mild steel shell finished in white stove enamel. The breaker frame is formed entirely in one piece of high impact plastic and no screws will be visible from the exterior. The door interior is of special design in laminated plastic again finished in white stove enamel.

Shelf area is 3½ sq ft. Two are shelves permitting a variety of shelf arrangements and two ice trays are provided. These make 3-4 lb of ice. The bottom part of the refrigerator is available as storage space 6 in. high by 18½ in. by 14½ in.

Price is £32 6s. 1d. plus £12 11s. 11d. tax making a total of £44 18s.



Astral's new floor model refrigerator



A New "Sol-etern" Lantern

NEW design of street-lighting lantern using 5 ft tubular fluorescent lamps has been marketed by REVO ELECTRIC LTD., Tipton, Staffs.

A development of the original Revo "Sol-etern" this new fitting is designed for two or three 80 W 5 ft fluorescent lamps and comprises a one-piece canopy in sheet aluminium and a one-piece perspex bowl hinged on one side and secured by toggle fasteners. The internal reflector assembly and gear tray hinges downwards to allow access to the control gear and bracket clamps. Spring-loaded lamp-holders also facilitate easy lamp replacement.

Keylight Bell Push

JUST introduced by MAURICE END LTD., Endina House, Blackfriars St., Manchester, 3, is a new illuminated bell-push.

Named the "Bloo-bar" bell-push it is a moulding in plastic with copper inserts. It is unique in its design, a small 2·5 W tubular festoon lamp is placed behind the blue translucent push and by means of small windows in the case of the push illuminates both the keyhole below and a built-in name plate above.

Operating from batteries or transformer the "Bloo-bar" bell-push is retailed at 7s 6d each.

Alto Electric Blankets

READY for the winter nights is the "Alto" electric blanket recently introduced by the WHOLESALE FITTINGS CO. LTD., 46 Commercial St., London, E.1.

This new line is produced in two sizes, single bed (60 in. by 30 in.) at £7 12s plus £1 7s 9d tax and double bed 60 in. by 50 in) at £11 10s plus £2 2s purchase tax.

Main features of the blanket are that it need not be removed while the user is in bed. It is washable, a loose cover being unnecessary, has three heat controls and complies with G.P.O. regulations concerning TV and radio interference suppression.

The double bed size is provided with separate switching enabling each half to be heat controlled independently. Available in blue, pink, camel or white the blankets have specially designed thermostats of which there are two in each circuit to ensure uniform heat.

New Magnetic Recording Tape

NOW in production by the M.S.S. RECORDING CO. LTD., Poyle Close, Colnbrook, Bucks, is a magnetic recording tape (type A.M.15) of high quality and medium coercivity, particularly suitable for use with low-speed recording machines operating at 7½ in. and 3¾ in. per second.

The tape which details at 377s 6d per 1,200 ft spool has a smooth finish claimed to guarantee a high performance and to cause minimum wear.

Development work on the new tape was first undertaken by British Insulated Callender's Cables Ltd. and later by the M.S.S. Co.

"Snow Gem" Lighting for Christmas

A CHARMING new series of fairylights for celebrations or festivities has been introduced by THE BRITISH THOMSON-HOUSTON CO. LTD., Crown House, Aldwych, W.C.2, in time for Christmas.

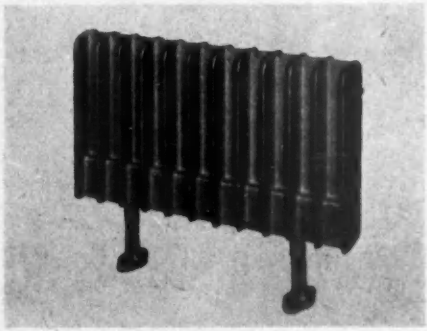
Unusual in shape and design they provide an atmosphere of great enchantment, particularly suitable for the home, shop-window or cinema foyer displays, or any type of decorative illumination.

The set consists of twelve sparkling "Snow Gem" individually coloured lights, each surrounded by an intricate design of white frost. Ready wired the set costs £2 1s. 6d., including purchase tax.

BTH's "Snow Gem" decorative lights

Radian Space Heating

A RANGE of electric space heaters has been introduced by Radian Sales and Service Divi-



Low surface temperature is one advantage of a Radian heater.

sion of TURDALE FOUNDRY LTD., c/o L. A. Glover, Stanmore Station, Middx.

The heater is a solid alloy finned casting with a Metrovick steel sheathed heating element rated at 750 W incorporated as an integral part. Twenty inches long by twelve inches high by three and a half inches deep the heater has a low surface temperature of 170° F but has an output of 2,560 B.Th.U. per hour. With metallic finish the heater can be provided with wall or floor brackets and sells at £8 15s. list price plus £4 11s. 11d. tax.

In this heater the electrical connections are totally enclosed with a terminal box located at the rear of the heater. It is strongly recommended by the firm that the heaters should operate under the control of a room thermostat.

The Stuart Bottle Heater

MANUFACTURED by the CHURN CO., Hailsham, Sussex, better known for their dairy utensils, is the "Stuart" infant feeding unit.

This comprises a metal canister base in which is fitted a heating element which warms the babies' bottles standing in the sockets provided. In the fourth larger socket is a small circular heating element which warms a heat-proof jug. Both elements are separately switched. An aluminium cover fits over the whole assembly including bottles and measuring jug making the unit portable and compact for travelling or for storage. This cover provides an excellent bowl for washing the bottles.

The makers who market the unit at £4 15s. retail claim that it maintains correct bottle temperatures and keeps feeds ready whilst providing trouble-free feeding washing up and sterilizing arrangements for travelling, the holidays, etc.

The unit when closed they say, can be used as a napkin airer or safety nursery heater. Standard models are for 200/250 V supplies but units are available for use from car batteries. etc.

Variable Flux for Flaw Detector

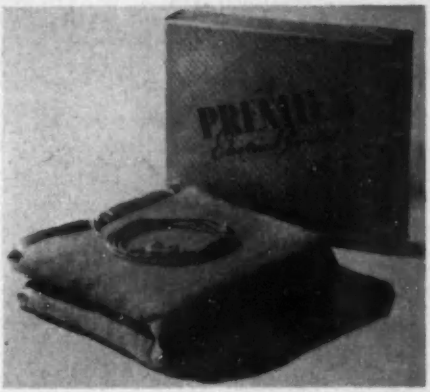
FEATURED in the revised version of the Minchom Sempun magnetic flaw detector manufactured by R.P.R. PATENTS LTD., Alexandra Palace Station, N.10, is means by which the flux in the completed magnetic circuit may be varied. Varying over a range stated to be from 100 gauss at a 2 in. gap to 350 gauss, the flux may be adjusted according to the size and nature of the article under test.

The unit itself comprises a central remagnetising coil, two side arms linked to self-setting pole brushes which make contact with the article. Linking between each section is by ball joints, the balls themselves being laminated in three sections one of which is of non-magnetic material. When the ball is turned to a given position this band of material is inserted in the magnetic circuit, and by virtue of its composition, constitutes an air gap thus reducing the final flux.

The Warm-well Blanket

SUMMER warmth for winter nights is ensured by use of a "Warm-well" electric blanket say the makers, PREMIER ELECTRIC HEATERS LTD., Keeley St., Birmingham, 9.

Made of soft woollen material with edges bound in rayon satin the "Warm-well" has a com-



The new Premier blanket is available in 3 colours

pletely protected heating element controlled by a 5 amp on-off switch. It measures 54 in. by 30 in. and is available in three colours: pink, blue and green (B.202, 203 and 204). It is suitable for use on d.c. supplies 200/220 V and 230/250 V a.c. and is priced £5 18s. list plus £1 1s. 6d. purchase tax. Poplin covers in the same colours as the blankets are available at £1 5s. plus 4s. 7d. tax. If ordered separately there is no purchase tax on these poplin covers.

Lamp Prices Up

INCREASED prices of electric lamps, operative from November 10, are announced by E.L.M.A. The new prices now range from 1s. 7½d., including p.t., for 40 W and 60 W clear and pearl single-coil lamps to 3s. 0½d., including tax, for 150 W clear and pearl single-coil lamps, and 3s. 7½d. for 150 W silica-coated single-coil lamps.

TRADE PUBLICATIONS

LIGHTING.—A pocket-sized but comprehensive lighting catalogue has just been issued by Ekco-Ensign Electric Ltd., 45 Essex St., Strand, W.C.2.

METEOROLOGICAL EQUIPMENT.—Issued by the equipment division of Mullard Ltd., Century House, Shaftesbury Avenue, London, W.C.2, describes the Radar Sonde, featured in the ELECTRICAL TIMES recently.

ELECTRICAL EQUIPMENT.—First issue of "Electricity in Industry," a new periodical review by the Lancashire Dynamo Group of Companies, brings yet another informative technical review into circulation.

The WEEK in NEWS

Bring Back Assisted Wiring Schemes

Deptford's Plea to resume Old Practice finds Support

IT has been suggested by Deptford borough council that the scheme for assisted wiring operated by municipally owned electricity supply undertakings before nationalisation, should be continued and/or resumed. The proposal has been placed before the Metropolitan Boroughs' Standing Joint Committee and the views of other councils are being sought. It has been found at Deptford that although responsibility for defective wiring rests between landlord and tenant, in many cases the landlord has refused to pay, with the result that the tenant has been faced either with the bill or no electricity. Under the old arrangement, the council would carry out the work and recover the cost over a period. The Electricity Board has stated that while they still maintain installations under the old scheme, the practice has been discontinued in respect of new installations. Main reason is because of restrictions on capital investments. They are therefore unable to help tenants whose wiring is defective and who cannot afford the cost of repair or renewal. Moreover, in the absence of any agreement there appears to be no legal liability to compel either landlord or tenant to repair wiring.

One council which has been approached to date is Poplar. They consider that such cases may be general and have therefore asked that the Committee to approach the Board with a view to finding a system whereby the latter can continue to operate assisted wiring schemes in respect of new installations. Fulham, too, are to press for a resumption of the scheme.

Birmingham Exhibition Opens in February

OFFICIAL opening of the new Birmingham Engineering Centre (see our issue of October 1) will be in February. The reconstructed building is expected to be completed and ready for occupation about the end of this year. Although invitations to take space at this permanent exhibition were dispatched only recently, we understand that nearly half the stands have been booked. Among electrical firms believed to have taken space at this early stage are Bill Switchgear Ltd., Donovan Electrical Co. Ltd., Herman Smith Smithlite Ltd., and Simplex Electric Co. Ltd.

Nickel Ban Removed

ALL restrictions on the use of nickel have been removed by the Board of Trade and Ministry of Supply as from November 6. The latter has withdrawn the alloy steel directions restricting the use of nickel in making alloy steels. A joint announcement was made last week.

B.E.A. Borrowings up to £60 Million

THE Treasury has issued a further guarantee to the B.E.A. in respect of borrowings during the final quarter of 1953. Maximum limit of temporary borrowings from the Clearing Banks and Scottish Banks or other sources has been fixed at £60 million. This replaces the guarantee given by the Treasury on June 26 last when the figure was £35 million.

Radio and TV Sales still above Last Year

LATEST figures issued by the R.T.R.A. on sales of radio and television sets show that in both instances the number of sets sold is still well above the corresponding sales in 1952. Radio continued to be more popular than television, but sales of the latter during August showed an increase over July, whereas fewer radio sets were sold in August than in July. Average number of radios sold per shop during August was 7·1 as compared with 7·23 in the preceding month and 5·63 in August, 1952. Similar figures as regards television sets were 6·19 last August, 5·96 in July and 5·29 in August last year.

The First Half-Century

I had an invitation to see a demonstration of a process for making coal out of peat, or rather for making something which should in many respects be better than coal, and should have the prime advantage of cheapness. The crude peat is put into a perforated cylinder which is then rapidly rotated so that the water is separated and thrown out by centrifugal force. A current is passed through the peat sufficient to heat it considerably and get rid of most of the remaining water, as also to break up the cells in some way not specified. Next, the peat is kneaded, teased and otherwise tormented till it is reduced to a putty-like paste, from which briquettes are moulded, each stamped "Peat Coal."—*From our issue of November* 12, 1903.

New Help for Exporters to Canada

B.S.I.'s List of Firms having Standards Approval

FRESH assistance for manufacturers in connection with the Canadian market is provided this week by the British Standards Institution. Just published is a list of some 400 manufacturers of electrical equipment who have now obtained approval of their products for export to Canada. This 40 page booklet, available from the B.S.I. free of charge, should be invaluable both to those wishing to obtain approved components for inclusion in completed equipment being exported, and to those contemplating breaking into the Canadian market for the first time.

The list classifies products under 19 sections. These include such items as machine tools, cleaning machines, domestic appliances, industrial and laboratory, electric motors, switchgear, and wires and cables. The firm's approval number and full name and address are also given. In addition there is a large miscellaneous section. Not included among the 400 companies listed are some 200 whose approvals are at present incomplete, but the present list will be supplemented quarterly with additional sheets.

Electricity Supplies to Building Sites Should be First Consideration

THE Minister of Housing has recommended that local authorities consider steps to arrange at an early stage with Electricity Boards for power supplies to be laid on at new building sites. The recommendation is contained in a circular letter sent to all local building authorities recently. Purpose of the letter was to draw attention to the many references in reports on the building industry to the advantages of having electricity laid on to sites before building operations begin. Main advantage is of course the wider use of power driven tools, but there was also the possibility of temporary lighting installations so that working hours could be extended.

It is suggested that work is fully planned in advance so that arrangements can be made for permanent cables and supply lines to be laid as soon as the contractor takes possession of the site. The Minister believes that contractors generally will welcome the opportunity to use electricity.

New Luncheon Club

AT a luncheon this week convened by Mr. A. B. Wildsmith, invited representatives of all sections of the Electrical Industry agreed to proceed with the formation of an Electrical Industries Luncheon Club.

As a first step to this end, a Committee and officers were appointed to consider details pursuant of such a decision. Mr. Wildsmith was elected chairman, with Mr. W. E. Babb as honorary secretary, Mr. H. F. Wickham, hon. social secretary, and Mr. H. S. Fothergill as honorary treasurer. The committee comprised: Sir John Dalton, Mr. J. Mortimer Hawkins who agreed to represent the Electrical Contractors for the time being, and Messrs. R. Baldwin, E. G. Batt, J. H. Campion, L. H. Codling, H. St. J. de A. Donisthorpe, A. S. Low, E. B. Sawyer and J. J. Thompson.

Automatic Accounts System at Grimsby

A COMPLETE reorganisation and modernisation of the system of compiling electricity bills has been introduced recently in the Yorkshire Board's Grimsby sub-area. Under a new punched card method, machines are used exclusively and apart from the girl operators, the meter readers appear to be the only human element involved now. Information in readers' books is marked on cards by means of punched holes, the cards are then sorted, inserted into another machine which works out and issues the printed bill. Receipts after payment are later sent to the same office for checking.

E.T.U. Officials in China

A DELEGATION of eight members of the Electrical Trades Union, recently in China as guests of the Electrical Power Workers Union there, held a press conference last week to disseminate news of their five weeks stay. Their tour included visits to Chinese Power Stations, of which one was the "new" hydro station at Kuantuig (commenced in 1917 and completed 32 years later) where eight 10 MW turbines are in operation. Supply is being standardised—for the power transmission system at 120 kV, and for l.v. systems at 220 V, 50 c/s.

Messrs. E. B. Sawyer, manager of E.L.M.A. Lighting Service Bureau, C. W. J. Scott, chairman of E.L.M.A. Council, and A. D. S. Atkinson, photographed at the opening of the 67th London Illumination Design Course

Lighting Applications in the Factory

FOR many weeks now the Midlands Electricity Board have run a series of exhibitions on various aspects of the applications of electricity to industry. The majority have been well attended and successful. Current display at the Chester St., Aston, showrooms is an exhibition entitled "Lighting for Efficiency and Productivity" in which the E.D.A. are taking a big part. Briefly this display has been divided into two. Firstly, a section deals with general factory lighting which will illustrate the effect of various methods of lighting and fittings on working efficiency, and also enable visitors to choose the right mode for their particular situation. The second section will deal with special applications of lighting, particularly as regards colour matching. The exhibition continues throughout next week.

OFFICIAL PUBLICATIONS

BRITISH STANDARDS.
B.S. 1673: Part 4: Methods of Testing Raw Rubber and Unvulcanized Compounded Rubber (Part 4: Evaluation of vulcanizing characteristics).
B.S. 830: 80 oz. and 90 oz. Winchester Bottles.
B.S. 2046: Protective Transformers (Current and voltage transformers for protective purposes).
HOUSES. "The Next Step." H.M.S.O. 9d.
CONTINUANCE OF EMERGENCY LEGISLATION (*see page* 925). H.M.S.O. 4d.
NICKEL PROHIBITED USES (REVOCATION) ORDERS, S.I. 1605 and S.I. 1607, Min. of Supply and B.o.T. H.M.S.O. 2d. each.
ERA REPORT.
N/T63: Bitter Figures on Single Crystals of Nickel and Nickel-Iron, by Prof. L. F. Bates and W. G. Wilson, 24s. 5d.

New Rubber College

THE National College of Rubber Technology was officially opened last week at Holloway. Hitherto, the rubber industry has done its training in the adjoining N. Polytechnic.

LIST OF APPROVED APPLIANCES CAUSES CONCERN

SOME dissatisfaction has been caused by the circulation to local authorities by the Ministry of Housing of a list of "approved domestic electrical appliances." The list was prepared last May by the Electrical Development Association at the request of the Ministry of Fuel and Power and was despatched about a month ago by the Ministry of Housing with the recommendation that any electrical appliances installed in houses should be limited to those included in the list. Some 400 appliances have been included, all of which are stated to have been approved either by the Association or by all Area Boards. Some manufacturers are now concerned because although their particular appliance has been approved by one or two Electricity Boards, it still might not qualify for inclusion in the list.

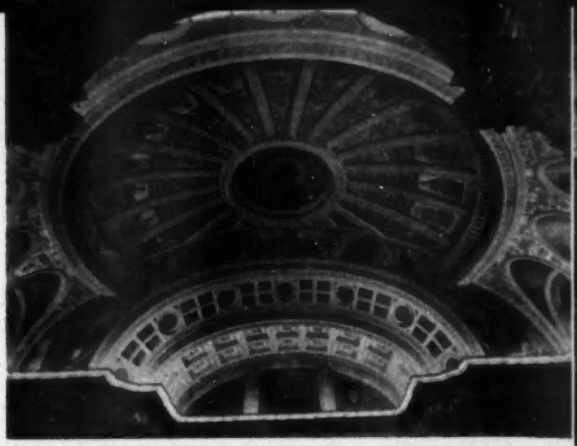
We understand, however, that the list issued last May will be added to periodically and addendum sheets despatched to the Ministries, and in turn presumably, to local authorities. Reason for the initial request by the Ministry of Fuel and Power was that similar lists had already been prepared in respect of gas and solid fuel appliances.

S.W. Display Trophy wrested from Devon

THE Challenge Cup awarded annually in the S.W. Electricity Board's Area for the best window display submitted in competition, has at last been taken from the Devon sub-area. It was becoming almost a foregone conclusion that the cup would be won by a Devon service centre as in the three previous years the winners were Dartmouth (1950), Bude (1951) and Torquay (1952). The privilege of upsetting this sequence has gone to the Tiverton showroom in the Taunton sub-area, who are the 1953 winners. Results were announced by the Board recently. It is nevertheless significant that Tiverton is only just over the sub-area border. Second in this year's contest were the Bristol North (Whiteladies Rd.) showroom, and third, as last year, were Penzance. The latter were particularly commended for the high standard achieved in the showroom interior, as well as in the window.

We understand there was little to choose between the first two displays, and general opinion resulting from the 1953 competition was one of great advancement in standard and technique. The winners made ingenious use of flashing lamps and a clock face with a moving hand which drew attention to the electric cooker and copy cards exhibited.

Display in the window of the Bristol North service centre in Whiteladies Rd., which won second prize in the S.W. Board's fourth annual window display competition. Eighty-five showrooms competed



These two excellent photographs show the richly decorated ceiling of the McEwan Hall, Edinburgh, illuminated now to good effect by cold cathode fluorescent lighting; and the installation trough reflectors and incandescent lamps 60 ft up on the capitals of the columns. In the picture on the right, the top left-hand corner corresponds with the bottom right-hand corner of our picture above

Outstanding Lighting at McEwan Hall

SOME most impressive photographs of the restored, redecorated and reilluminated McEwan Hall in Edinburgh reached us last week. New ventilation, heating and lighting systems formed part of the work of restoration and the last is particularly remarkable, as for the first time the magnificently decorated ceilings have been made visible. This has been facilitated by good use of cold cathode fluorescent lighting. The installation comprises a cornice of straight and angled steel frames carrying four runs of cold cathode lamps, the total lighted length of lamp run being 1,200 ft. Fittings have been mounted at a height of 60 ft. It should of course be mentioned that this great hall is 100 ft in width and about 100 ft high overall.

The upper gallery has been illuminated by 14 trough reflectors, each of which houses three 75 W incandescent lamps, which are mounted on the capitals of columns. The lower gallery has 14 spun indirect reflectors, each housing three 75 W tungsten lamps, mounted with curved back plates on the column radius. This method of illumination was the idea of Mr. J. Hamilton, master of works at Edinburgh University, who supervised the installation of equipment supplied by George Forrest and Son Ltd.

Incidentally, this same hall was the scene last week of H.R.H. the Duke of Edinburgh's installation as Chancellor of the University. The fine new setting was truly appropriate to the ceremony, as it will be also for the many graduation ceremonies, concerts and other functions.

Defence Regulation Changes

DURING 1953, 76 Defence and similar regulations were revoked or allowed to lapse. This is stated in a Government White Paper, "Continuance of Emergency Legislation," which was issued last week. In addition, there were several partial revocations, including one of Regulation 56, which formerly covered the giving of directions to all public utility undertakings. It is now limited to transport and water undertakings.

Among other regulations which are to be continued in force for a further year are the Defence (Patents, Trade Marks, Etc.) Regulations 1941, so far as Regulations 1, 2 and 3 (3)-(5) are concerned. These cover patents for inventions of interest to defence authorities. Certain other temporary provisions of the same nature referring to the 1949 Patents and Registered Designs Acts are also to be continued.

CANADA NEEDS MORE TRAINED ENGINEERS

H.E. the High Commissioner for Canada, Mr. N. A. Robertson, gave some facts about current conditions in Canada when he spoke at the annual dinner of the B.T.H. Overseas Association recently. His main theme was the shortage of available engineers to assist the country's rapid development, especially when looking to the future. He instanced the Dept. of Labour's survey estimating the percentage of employers who expect to be short of engineers in the next three years. In the electrical industry he said 13% of employers anticipate shortages—second only to the petroleum industry.

Mr. Robertson had a word of praise for the various schemes whereby Canadian engineers received training in Britain, particularly the Athlone Fellowships scheme. Despite the need for more engineers, Canada would continue to develop fast, Mr. Robertson assured the Association. Primary factor in her advancement was the abundant supply of reasonably cheap hydro-electric power. Canada produced 15% of the world's hydro-electric power and vast potential supplies remained to be developed. He recalled that capital expenditure in 1952 was over $5,000 million, compared with $700 million in 1939.

A.P.C.M. Tariff Complaint not Settled Yet

THE Eastern Electricity Consultative Council is still investigating tariff complaints lodged by the Associated Portland Cement Manufacturers Ltd. Representations were first made early this year, and despite the offer of new terms the company remains dissatisfied, and fresh representations have been made recently. A new report had been prepared by the Council's tariff sub-committee for submission at last Friday's meeting but a representative of the company and the Board's chairman met the sub-committee previously and in the light of that meeting the report has been taken back for further consideration. On the other hand Enfield Rolling Mills Ltd. are now satisfied with new proposals made by the Board.

The council has been informed that the Board has started its promised review of new standard tariffs. The review is intended to iron out any anomalies in the new tariffs. Included in the review will be the subject of charges to churches, village halls and the like. The Council's earlier representations on standardisation of hire purchase charges has now reach the C.A.

I.E.E. Annual Dinner on Merseyside

THERE were over 160 members and guests present at the annual dinner of the I.E.E.'s Merseyside and N. Wales Centre held on Monday. T. Alker, the city's town clerk, called attention to the importance of professional institutions in the pattern of modern life. I.E.E. vice-president, Mr. T. E. Goldup, spoke of the Institution's long tradition. He quoted figures in support of the establishment of National Certificates. On the same theme Mr. E. W. Ashby, past-chairman of the centre, asked for assistance at national level for technical colleges.

Radioisotope Conference

OVER 500 delegates from Britain and overseas attended a very successful conference on the peaceful uses of radioisotopes in Oxford in 1951. The venture is to be repeated next year by the Atomic Energy Research Establishment. The conference will again be held in Oxford and will open on July 19 for five days. An exhibition of instruments and techniques will be held coincidentally.

Salesmen visit England

SALES executives of Hoover Ltd. on the Continent recently made the journey to England for a special presentation luncheon. At this function, Dr. I. Mottola, sales director in Italy, received the overseas sales cup won in competition against Hoover associate companies in France, Switzerland, Belgium and Holland.

NEW BETATRON IN MANCHESTER HOSPITAL

THE 20-million volt X-ray equipment made by Metropolitan-Vickers Electrical Co. Ltd., and known as a Betatron, has been installed at the Christie Hospital and Holt Radium Institute in Manchester. The equipment has been presented to the Hospital and now stands in the new Betatron Research Building. It is believed to be the first Betatron in this country to be installed for radio therapy. Tests have not yet been completed but the machine is already working at 20 million volts. X-rays thus generated are far more penetrating than ordinary X-rays, and allow a destructive dose X-radiation to be delivered to a deep-seated tumour without damage to the skin and intervening tissue.

Some Comments on Cost of Electricity

A VIGOROUS protest is to be addressed to the Yorkshire Electricity Board as a result of a resolution passed by **Huddersfield** Chamber of Trade. The protest follows the introduction of new charges allegedly without prior consultation with traders. "Barefaced robbery" was the description given to the system of taking into account floor space regardless of whether all the space was used.

Rural councillors at **Yeovil** have complained about line rentals. A resolution there states that all classes of consumer in the south-west are penalised by having to pay more than consumers elsewhere, and that a rural dweller is doubly penalised by the imposition of line rentals.

A promise that there would be no increase in charges during the coming year was made by Sir Joseph Hallsworth, chairman of the N.W. Board, at **Preston** recently. He warned however that any sharp rise in the price of coal would cancel that promise. In his general review, Sir Joseph was optimistic about the future, and anticipated that the Board would show another surplus at the end of 1953-54.

Despite assurances that electric water heaters would be cheaper than gas, **Eastbourne** tenants are adamant about using the latter. The Electricity Board has pointed out that although installation costs were about the same, running costs favoured electric heaters by about 1s. 6d. a week. Despite the wish of council tenants on the Langley Green estate, the housing committee is to review the matter in respect of future building schemes.

Harrogate council are changing their maintenance policy. We hear that for a trial period of six months, electrical repairs will be carried out by the street lighting section of the Borough Engineer's department.

Abolition of purchase tax on household equipment was the plea of women at the Scottish Women's Rural Institute's conference in **Edinburgh.** Tools of the factory worker are not taxed, so why should the tools of trade of the housewife be taxed? was one argument.

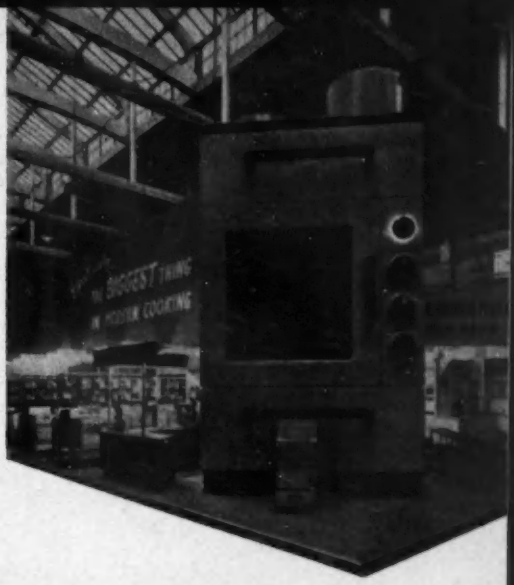
Sport Highlighted at Henley's 11th Conversazione

AT each of the ten previous annual Students' Conversaziones held by W. T. Henley's Telegraph Works Co. Ltd., Sir Montague Hughman has presented the prizes. He was to have handed over this responsibility to Sir John Dalton, the company's new chairman, personally at the eleventh function last Saturday but was unfortunately prevented from doing so by illness. Sir Montague's pleasant tasks of the past decade were undertaken by his successor, Sir John, who by his keen interest in youth and especially in their education, is a more than worthy successor. Nearly 100 students received awards; two of them are now studying at Bristol University.

Sports and athletics were the theme of this year's assembly at Woolwich Polytechnic, highlighted by the presence and amusing and informative discourse on the 1952 Olympic Games in Helsinki, by Team Manager Mr. Jack Crump. Exhibits of handicrafts and other displays were also predominantly sport with demonstrations of wrestling, fencing and weightlifting. The day was rounded off with a pageant of British history, music, drama and comedy — "Coronation Cavalcade." A presentation was made to Mr. E. Guy, retiring principal of Gravesend Technical College, by Dr. P. Dunsheath, director, who presided.

L.E.S. Annual Dance

LAST week's Annual Dance for the staff and friends of L.E.S. Distributors Ltd., held at the Shaftesbury Hotel, was characterised by the friendly and jovial atmosphere which was maintained throughout the evening. One highlight of the event was the presentation of watches to members of the organisation, notably Mr. G. V. Ormsby, one of the directors, as a mark of the company's appreciation of long service.



"Electricity—the biggest thing in modern cooking" appears a very apt caption for this display. This must surely be the world's largest cooker, and as the feature of the S.W. Scotland Electricity Board's stand, dominated the recent Modern Homes Exhibition held in the Kelvin Hall, Glasgow

NEWS IN BRIEF

B.S.I. has set up a section to deal with approval in the U.K. of air receivers, boilers and pressure vessels intended for export to Canada.

New radio link between New Zealand and Britain has been established to be used for Royal broadcasts during the Commonwealth tour, we are informed by Standard Telephones and Cables Ltd. The Queen will deliver her Christmas Day broadcast from Auckland.

Annual Court of Governors of the Commercial Travellers' Benevolent Institution will be held at Berners Hotel, W.1, on December 28 at 12 noon.

Annual meeting of the Electrical Trades' Commercial Travellers' Association will take place at Feathers Hotel, Westminster, on November 20 at 6 p.m.

The House of Seagram are exhibiting their collection of paintings of the cities of Canada by Canadian artists, at 45, Park Lane, W.1. The display closes on Saturday.

There is no longer any control on the maximum prices of vertically cast- and spun-iron pipes and special iron castings, cast-iron drain pipes and fittings, forged alloy, gun billets, railway tyres, wheels and axles and other forgings, under Defence (General) Regulations.

One-day course for the Society of Housing Managers on "Care and Maintenance of Household Electrical Installations and Appliances" was organised by E. A. W. at the Electricity Service Centre in Manchester's Town Hall extension last Friday.

Selling price for tungsten ores of standard 65% grade and ordinary quality have been reduced as follows: Wolframite to 245s. and Scheelite to 230s. per long ton unit delivered consumers' works.

Exchange of Atomic Power Information

THE possibility of exchanging information with the U.S. on developments in the use of nuclear energy for the generation of electricity was the subject of a question in the Commons on Monday by Mr. G. Nabarro. The Minister of Supply replied that the Government had frequently intimated that they would welcome collaboration on a reciprocal basis. He did not think we should advise America to alter their legislation to allow this. There was little more the U.K. could do at present in this field but it was felt that such an exchange of information would be advantageous to both countries.

Electric Supply News . . .

Eastern Board

During the month of August the Eastern Electricity Board connected 4,572 new consumers including 83 farms. The corresponding figures for July were 4,552 consumers and 65 farms. Mains extensions amounted to 28 miles of l.v. and 24·2 miles of h.v. line during August, and 35·8 miles of l.v. and 32·3 miles of h.v. in July.

Glamorgan

A proposal of the British Electricity Authority to construct a power station at Aberthaw was discussed at last week's meeting of a subcommittee of Glamorgan County Council Planning Committee.

Lincoln

Objections to the B.E.A.'s proposal to extend St. Swithin's power station, at a cost of over £2,600,000, were heard at a public inquiry held by Mr. H. W. Grimmitt, chief engineering inspector for the Ministry of Fuel and Power last week. The objections chiefly concerned the emission of coal dust and spray from the cooling towers. Mr. F. Favell, chief generation construction engineer to the East Midland division of the B.E.A. stated that it was proposed to fit eliminators to the existing towers and incorporate them in the proposed two new towers. These eliminators would operate with an efficiency of 98%. Answering a question by Mr. Hodgeson, representing Lincoln Corporation, he said the B.E.A. could give an assurance that they would provide some effective means of stopping the grit and smoke from the chimneys. The boiler plant would be fitted with dust collecting equipment. The inquiry was concluded.

Northern Ireland

The proposed River Bann hydro-electric scheme was the subject of a public inquiry held by the Ministry of Commerce at Coleraine last week. Objectors were local farmers, landowners and owners of fishing rights of the river. Outlining the scheme, which is estimated to cost about £2 million, Mr. B. D. Richards of Sir William Halcrow and Partners said it would be essentially a run of the river scheme using water as let down by the drainage authorities. It was proposed to put in about 15,000 kW of plant, and the average power would be about 6,000 kW. About 600 acres of land would be flooded. In his evidence, Mr. G. F. Kennedy, of Kennedy and Donkin, stated that the saving of coal was estimated at £25,000 per annum. If the scheme was not proceeded with and it was decided to increase the plants at Ballylumford and Belfast equivalently, the cost would be about £1,050,000. Mr. T. G. Christie, chief engineer of the Electricity Board for N. Ireland, told the inquiry that the scheme would be of some advantage to the Board apart from the question of cost. Carnroe would be well sited to feed into the transmission systems in the vicinity. They would have to erect a h.t. line from Carnroe to Ballymena. During subsequent evidence, a number of farmers stressed that they would lose a large proportion of their holdings, making it uneconomic to continue to farm. Another witness, Capt. Ellis, managing director of Toome Eel Fisheries Ltd., stated that under the proposals they would be left only with Toome weir from which the profit would be about £1,000 per annum, which he considered uneconomic. It was later agreed to adjourn the inquiry until December 8 to enable the fishery interests further time to prepare evidence.

S.W. Scotland

Schemes to provide a supply of electricity to over 1,500 houses at four sites, have been approved by the South West Scotland Electricity Board. One scheme concerns 251 houses at Mains (East) V site, East Kilbride, the estimated cost being £14,254; the second is for 262 houses at Haldane Street, Balloch, at a cost of £19,632; the third is for 312 houses at Faifley site, Clydebank, the cost being £23,664; and finally, for supplying to 715 houses at Glenburn site, Paisley, estimated cost £32,216. In addition the Board have authorised a scheme to supply the N.C.B. collieries and works to the North and North-west of Dalemillington, Ayrshire, where the total demand is estimated at 2,400/3,000 kW.

The Board also announces that it has amalgamated the Dumfries and Thornhill districts of the Dumfries and Galloway sub-area, the combined district to be known as Dumfries District. The Moffat section previously in the Thornhill district has been transferred to Annan district.

Worcestershire

In order to ensure that a public inquiry will be held into the B.E.A.'s proposal to erect a supergrid of o.h. lines through the county from Melksham to Hams Hall power station, Birmingham, Worcestershire County Council has registered its objection to the scheme. The Council decided to object to the carrying of a line on high towers "through an area of high amenity and fertility and also to the extension of the route over the Cotswolds, because it would be visible from a long way off."

LIGHTING SCHEMES

Holborn.—The Borough Council has approved a £20,000 scheme for the installation of fluorescent lighting in New Oxford Street, Tottenham Court Road, Charing Cross Road and Shaftesbury Avenue.

Omagh.—The U.D.C. has approved a scheme for electric lighting of streets at a cost of £10,000.

Poplar.—B.C. has approved scheme for installations of sodium lamps in Priory St. and Teviot St.

Company Activities . . .

Burco Ltd.

An appreciable increase in the net profit for the year ended September 30 is reported. At £62,560 that figure is £8,279 higher than for the previous year. The final dividend is 30%, again making a total of 35% for the year. The directors state that application has been made to the Capital Issues Committee for permission to issue bonus shares by capitalisation of reserves.

Bullers Ltd.

This concern again suffered a sharp drop in profits for the year ended July 31 last, as will be seen from our accompanying table. But whereas in the previous year it was the iron-

Year to July 31	£ Trading Profit	£ Net Profit	% on Ord. Earn'd	% on Ord. Paid	Ord. Price High	Ord. Price Low
1949	304,281	115,044	129	15	27/10½	25/-
1950	367,137	151,106	171	15	27/6	24/10½
1951	365,689	138,167	128	15*	30/8	25/-
1952	307,975	112,265	82	15†	25/6	24/1
1953	232,745	86,825	60	15	26/9	24/6

* Plus 28% capital bonus † Plus 25% capital bonus.

works which suffered from a shortage of steel, for the period just ended it was the Porcelain Works which was affected by a trade recession, according to Mr. G. H. Harris, the chairman. But trading conditions are now normal.

Dowding and Mills

These repairers of heavy electrical equipment report another successful year, as our accompanying table of the past five years' operations indicates. The balance sheet for the past year shows that stock has been reduced, and together with work in progress it was valued at £15,745 at June 30 last compared with £26,455 a year previously. The £40,000 Debenture is repayable

Year to June30	£ Trading Profit	£ Net Profit	% on Ord. Earn'd	% on Ord. Paid	Ord. Price High	Ord. Price Low
1949	48,166	18,244	70	37½*	17/9	4/1½
1950	58,441	21,603	83	50	7/10½	5/-
1951	58,039	15,032	60	50	9/3½	7/3
1952	68,706	16,235	65	50	7/-	6/-
1953	79,786	22,254	85	50	6/9	6/3

* Plus 300% capital bonus.

in ten yearly instalments, but the directors are considering repaying this in a shorter period.

Electrical Components Ltd.

The directors have decided that the remaining 43,500 5½% Cumulative Redeemable Preference shares shall be issued forthwith at a price of 20s. 6d. each. They are to be offered to Ordinary and Preference shareholders.

English Electric Co. Ltd.

It is proposed to issue 3,538,731 £1 Ordinary shares by capitalising reserves, in the proportion of one for every £2 of Ordinary stock held. Treasury consent has been obtained.

Falk, Stadelmann and Co.

This past year was a complex one for this company. There was a reduction in sales by certain departments, the cooker, domestic appliances and oil-burning sections chiefly suf-

Year to Mar. 31	£ Trading Profit	£ Net Profit*	% on Ord. Earn'd	% on Ord. Paid	Ord. Price High	Ord. Price Low
1949	516,565	144,980	40	15	47/3	35/7
1950	484,562	168,374	48	15	43/-	31/3
1951	572,425	194,329	55	15†	50/-	40/-
1952	662,419	178,708	50	15	41/3	34/3
1953	406,069	46,046	6·2	15	43/9	40/7

* Available for the parent company.
† On larger capital.

fering, Mr. H. Falk, the chairman, reports. Export sales to date are still below last year's figures, but there are signs of improvement. In order to obtain more effective co-ordination between factories, it has been decided to consolidate some of the smaller units at the firm's larger works.

Heenan and Froude Ltd.

The group net profit, before taxation, for the year ended August 29 last is £367,113 compared with £394,003 for the previous year. The final Ordinary dividend is 10% making 15%.

A. H. Hunt (Capacitors) Ltd.

To finance an extension of activities in the Canadian market, the directors have decided to issue 100,000 Ordinary shares of 4s., at a price 10s. each, to Ordinary holders in the proportion of four for 29 held.

Oliver Pell Control Ltd.

At £34,733 the trading profit for the year ended March 31 last is £1,540 higher than that for the previous twelve months. After all charges, including taxation, the net profit amounts to £20,012 (*£20,975*).

Rawlings Brothers Ltd.

This electrical contracting and engineering concern reports a group net trading profit of £18,637. The dividend is again 7½%.

Taylor Tunnicliff (Electrical Industries)

Treasury approval has been received to the capitalisation of £300,000 of reserves, and the distribution of 1,200,000 fully paid Ordinary 5s. shares in the ratio of one-for-one.

Tube Investments Ltd.

The final Ordinary dividend of 7½% makes a total distribution for the year ended July 31 last of 15% on the larger capital. After charging tax, the group net profit is £2,720,172.

Dividends Declared

Broadcast Relay Service.—Interim of 10% (*8%*) tax free.

Ward and Goldstone.—Interim of 15% (*same*).

G. and J. Weir.—Interim of 5% (*same*).

Yarrow and Co. Ltd.—Dividend is 20% (*same*). Group net profit £105,544 (*£108,818*).

Commercial Information

CONTRACTS OPEN

HOME

Dates given are the final for receipt o tenders, unless otherwise stated

13 Nov.—Sheffield T.C. Installation at King Edward VII school.—See Oct. 29 issue.

14 Nov.—Macclesfield T.C. Street lighting.—Advertised in Oct. 29 issue.

14 Nov.—Preston T.C. Equipment for Larches Hostel.—See Oct. 29 issue.

14 Nov.—Rochester T.C. Street lighting.—See Oct. 29 issue.

16 Nov.—Bradford. Lamps during 1954 for Royal Infirmary.—See Oct. 29 issue.

16 Nov.—N. Ireland. Installation in 157 dwellings at Andesontown.—See Nov. 5 issue.

16 Nov.—Peterborough T.C. Street lighting along Westwood Farm Rd.—See Nov. 5 issue.

16 Nov.—Wrexham T.C. Street lighting.—Advertised in Nov. 5 issue.

17 Nov.—Docking (Nfk.) R.D.C. Wiring in dwellings at E. Rudham and Bircham, Snettisham and Heacham.—See Nov. 5 issue.

18 Nov.—Clitheroe T.C. Street lighting on trunk road A59.—See Nov. 5 issue.

18 Nov.—Devonshire. Lighting installations to be carried out during Christmas holidays at following schools: East Worlington, Fremington, Georgeham, Kingsnympton, Parracombe, and Tiverton. County Architect is H. V. de Courcy Hague, 97 Heavitree Rd., Exeter.

18 Nov.—Newcastle - on - Tyne T.C. Installation in 81 houses on Kenton North estate.—See Nov. 5 issue.

18 Nov.—Wem (Salop) R.D.C. Installation in houses.—See Oct. 22 issue.

18 Nov.—West Riding. Electrical installation in "Dunford House" ambulance depot., Wath. County Architect, "Bishopgarth," Westfield Rd., Wakefield.

19 Nov.—Edmonton T.C. Supply and erection of 92 concrete columns and mercury vapour lamps in Group A for part of Great Cambridge Rd. Borough Engineer and Surveyor, Town Hall, N.9. Deposit £2 2s.

19 Nov.—Northern Ireland. Electrical installation at Holywood intermediate school, Co. Down. Munce and Kennedy, 133 University St., Belfast. Deposit £3 3s.

20 Nov.—Barking T.C. Supply and erection of 46 street lighting columns to group A standard, with 400 W MA/V lamps, lanterns and auxiliary equipment. Borough Engineer and Surveyor, Town Hall.

20 Nov.—Belfast T.C. Transformers for Power Station West.—Advertised in Oct. 15 issue.

20 Nov.—Belfast T.C. 33 kV 6·6 kV and auxiliary cables, etc., at sub-stations.—Advertised in Oct. 8 issue.

20 Nov.—Co. Kildare. Pumping plant in Ballytore water scheme.—See Oct. 8 issue.

20 Nov.—Dublin. Supplies for Gt. Northern Railways.—See Nov. 5 issue.

20 Nov.—Londonderry. Installation at Ballyrashane school.—See Oct. 22 issue.

20 Nov.—Londonderry. Electrical installation at Tobermore primary school extension. County Educ. Architect, Education Office, New Row, Coleraine. Deposit £1.

20 Nov.—Luton T.C. Electrical installation in hangar and annexes at Luton airport. Borough Engineer, Town Hall. Deposit £2 2s.

23 Nov.—Blofield and Flegg (Nfk.) R.D.C. Vertical spindle borehole type pumps.—See Oct. 15 issue.

23 Nov.—Northern Ireland. Electrical installation in occupational therapy dept. at Royal Victoria Hospital. Architects, Young and Mackenzie, 143 Scottish Provident Buildings, 7 Donegall Sq. West, Belfast. Deposit £5 5s.

23 Nov.—Wisbech T.C. Street lighting.—See Oct. 29 issue.

25 Nov.—Clutton R.D.C. Installation in 10 houses at Hinton Blewett.—See Nov. 5 issue.

25 Nov.—Dublin. Installation at Portrane Mental Hospital.—See Nov. 5 issue.

25 Nov.—Wandsworth B.C. Supply of armoured and twin rubber covered cable. Borough Engineer, Municipal Buildings, S.W. 18.—Advertised in this issue.

27 Nov.—Farnham U.D.C. Supply of equipment for lighting 7 pedestrian crossings. N. P. Youldon, acting engineer and surveyor, Council Offices Annexe, South St.

27 Nov.—N. Ireland. Installation at Whiteabbey Hospital, Antrim.—See Nov. 5 issue.

30 Nov.—Bournemouth T.C. Equipment for sub-stations.—Advertised in Nov. 5 issue.

30 Nov.—Dover T.C. (a) Supply of 151 sets of lanterns with 400 W H.P.M.V. lamps, gear, timeswitches, etc., to group (a); and (b) supply and erection of 122 steel and 29 concrete columns, fixing of units and auxiliary equipment, and wiring. Both for lighting trunk road A2. Deposit £2 2s. in respect of (b). Separate contracts. Borough Engineer, Brook House.—Both advertised in this issue.

30 Nov.—St. Helens T.C. Supply and erection, etc., of fifty 25 ft. concrete columns with 250 W new restricted cut-off type H.P.M.V. lanterns, and four 15 ft. concrete columns with 125 W H.P.M.V. lanterns. M. Ward, Borough Engineer, Town Hall. Deposit £2 2s.—Advertised in this issue.

30 Nov.—Tottenham B.C. Supply of lamps during 1954-55.—See Oct. 15 issue.

3 Dec.—Co. Down. Electrical installation in kitchen and dining hall of Castlewellan intermediate school. Architect. Henry Lynn, 110 Scottish Provident Buildings, Belfast. Deposit. £3 3s.

4 Dec.—Belfast T.C. Crane, switchgear, etc.—Advertised in Oct. 15 issue.

4 Dec.—Deben (Suff.) R.D.C. Supply and installation of submersible-type centrifugal pump and electric motor. Consulting Engineers, Pick, Everard, Keay and Guinson, 6 Millstone Lane, Leicester. Deposit £2 2s.

5 Dec.—Longbenton U.D.C. Electrical installation in 22 houses on Kelvin Park estate—contract 40. A. E. Sweetman, Engineer and Surveyor. Council Offices, Forest Hall, Newcastle-on-Tyne. Deposit £2 2s.

5 Dec.—Stockport T.C. Electrical installation in 101 dwellings on Brimmington estate. Applications to Borough Surveyor, Town Hall by Nov. 14.

7 Dec.—Aberdeen T.C. Electrical work in erection of offices, workshops, etc., at Cattofield Place. City Engineer, 21a St. Nicholas St.

7 Dec.—Salford T.C. Installation of electric call system in 4 bathing establishments. General Superintendent, Admin. Offices, Blackfriars Public Baths.—Advertised in this issue.

11 Dec.—Belfast T.C. Boiler units for Power Station West.—Advertised in Oct. 1 issue.

11 Dec.—Belfast T.C. Exhaust piping with valves and electrical controls for Power Station West.—Advertised in Oct. 15 issue.

18 Dec.—Belfast T.C. Turbo-alternators, feed heating and condensing plants sets, generator transformers, and circulating water pumps for Power Station West.—Advertised in Oct. 15 issue.

18 Dec.—Belfast T.C. 110 kV oil pressure or gas type, and 33 kV main cables, auxiliary cables and accessories.—Advertised in Nov. 5 issue.

18 Dec.—Windsor T.C. Electrical installation in 36 flats in Dedworth Rd. Borough Engineer, Kipling Memorial Building. Deposit £1 1s.

4 Jan.—Lancaster T.C. Pumping plants for Lune St., Scale Hall, and Willow Lane pumping stations.—See Nov. 5 issue.

OVERSEAS

*Details of items marked * may be obtained on application to the Board of Trade, Lacon House, Theobalds Road, W.C.1, quoting reference.*

28 Nov.—Egypt. Supply, erection and installation of switching and transformer substations and associated cable system for Cairo International Airport and territory. Documents from Chief Inspecting Engineer, Egyptian Govt., 41 Tothill St., London S.W.1, quoting ref. 44/Elect. and Gas 3/2/582.—Advertised in this issue.

4 Dec.—Uruguay. Supply of about 10,000 insulators (porcelain) required for voltage of 6 kV between phases. Administracion General de las Usinas Electricas y los Telefonos del Estado. B.o.T. (Ref.: ESB 7850/53).*

6 Jan.—South Africa. Tenders invited (contract 125) for eighteen 600 A and one 2,400 A 6·6 kV double busbar 500 MVA circuit breakers, and eleven 400 A 6·6 kV single busbar 250 MVA circuit-breakers for City of Johannesburg. Stores and Buying Branch, Room 208, Panama Hse., 200 Commissioner St. B.o.T. (Ref.: ESB 8107/53)*.

8 Jan.—Australia. Brisbane City Council requires supply of 20,000 10-40 amperes (long range) 240 V single-phase, a.c. kW/hr meters. Contract E27/53. Town Clerk, City Hall, Brisbane. B.o.T. (Ref.: ESB 8145/53)*.

14 Jan.—India. Supply of h.t. and l.t. circuit-breakers to value of about Rs5, 53,000s. Controller of Stores, Electric Hse., Fort, Bombay, on payment of Rs5s. plus sales tax.

2 Feb.—New Zealand. Supply of of 23 33 kV 350, 500 and 750 MVA 3-phase oil circuit-breakers and accessories for operation on a 33 kV 3-phase 50 c/s system in which neutral point is solidly earthed. Tender No. 248. State Hydro-electric Dept., Wellington. B.o.T. (Ref.: ESB 6747/53)*.

16 Feb.—New Zealand. Supply of two 220 kV 3-phase airbreak switches for normal current of 600 amps. min. and 5 secs. duration current of 30,000 amps. Contract 250. State Hydro-electric Dept., Wellington. B.o.T. (Ref.: ESB 8273/53)*.

CONTRACTS PLACED

Epsom T.C. Lighting columns and equipment for improvement scheme along A24, Harland and Wolff, Ltd., £1,213.

Hampstead B.C. Supply of apparatus for lighting pedestrian crossings, Franco Traffic Signs, Ltd., £1,086.

Hartlepool T.C. Street lighting in Cleveland and Hart Rds., Revo Electric Co., Ltd., £1,510.

Holborn B.C. Electrical installation on Endsleigh St. site, W. T. Clarke and Co., Ltd., £1,703.

Lambeth B.C. Laying of cables to 140 new street lamp columns, London Electricity Board, £2,120.

Middleton (Lancs.) T.C. Electrical work on 140 houses and 24 flats on Hollin estate, Marlow Electrical Co., £3,721.

Your Queries — Answered

"Deren" convector heaters, makers of? D.E.—These were made by De Renzi Holmes and Co., Ltd., Fox's Lane, Wolverhampton, the assets of which were purchased by V. G. Howell and Co., Ltd., Crown St., Wolverhampton, who are continuing the range of industrial electrical equipment and abandoning the range of "Deren" domestic appliances. Spares are available. (24526)

Stevco, Ltd., noted in the review of the Motor Show, address of? F.L.—8/9 Rewley Rd., Oxford. (24549)

"Raysol" sun lamps, makers of? G.E.—Raysol Electric Co., 550 Holloway Rd., N.7. (24563)

"Stersalite" lamps, makers of? E.D.—Albion Electric Lamp Works (1934), Ltd., 127 Old Brompton Rd., S.W.7. (24578)

"Maisyvac" vacuum cleaners, makers of? L.B.—Sterling Engineering Co., Ltd., Sterling Works, Dagenham. (24583)

"Botrade" switchgear, makers of? T.E.—Bill Switchgear, Ltd., Aston Lane, Perry Barr, Birmingham 20. (24597)

The above are selected from questions we have answered this week. If you have a query, send it to us.

GAZETTE ANNOUNCEMENTS

COMPANIES ACTS

Monarfon Radio Ltd. Resolution passed at meeting on Oct. 29, for voluntary winding-up. S. Oliver Henry, acc., 5 Rumford Place, Liverpool, has been appointed liquidator.

Round and Green (Birmingham) Ltd. Liquidator, A. C. George, Dilworth Hse., 190 Broad St., Birmingham, released as from Sept. 3.

BANKRUPTCY ACTS

Release of Trustee

Leicester. Gordon Wilson, electrical engineer trading at 1 Abney St., Leicester. Trustee was E. C. Stimpson, Official Receiver, 22 Regent St., Park Row, Nottingham.

Appointment of Trustee

Southampton. Sidney F. Wilkins, electrical engineer of 26 Queen St., Lymington. Trustee is L. F. Hope Jones, 63 High St., Lymington.

Intended Dividends

Whitehaven. Roland L. Newell, trading as R. and R. Newell, electrical engineer, at High Bank Mill, Egremont. Last day for receiving proofs, Nov. 21. Trustee is D. Atkinson, Official Receiver, 14 Lowther St., Carlisle.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Aladdin, 718,719. Class 9. Electric kitchen utensils. Aladdin Industries Ltd., Aladdin Buildings, Western Ave., Greenford.

Barduct. B715,952. Class 9. Electric current transmission systems. Marryat and Place Ltd., 40 Hatton Garden, E.C.1.

B-Burndept. in design. 712,233. Class 9. Specification includes: batteries, pocket lamp cases, electronic apparatus, etc. Burndept Ltd., 681 Salisbury House, Finsbury Circus, E.C.2.

Ekco. 721,843. Class 9. Television receiving apparatus. E. K. Cole, Ltd., Ekco Works, Southend-on-Sea.

Fec. 719,794. Class 9. Apparatus and instruments, etc. London Electrical Mfg. Co., Ltd., Beavor Lane, W.6.

Falks Gadabout. 722,182. Class 9. Electric irons. Falk, Stadelman & Co., Ltd., 91 Farringdon Road, E.C.1.

PRICE OF CABLE METALS AND OTHER MATERIALS

(Official close at Tuesday, Nov. 10)

	£ per ton	Weekly change
COPPER, standard class A	236-238	—1½/4½
(3 months)	221-221½	—2½/2½
LEAD, refined pig, min. 99.97% purity	93½-93¾	—2/2
(3 months)	89½-90	—½/½
TIN, refined, min. 99.75% purity ...	615-620	0/+2½
(3 months)	605-607½	0/0
ALUMINIUM, ingots 99-99.5% (del.) ...	150	—
ZINC, virgin, min. 98% purity	75½-75¾	—½/½
(3 months)	74-74¼	0/0
RUBBER No. 1, RSS. spot (per lb.) ...	16¾d.-17d.	+⅛/⅛
(3 months) (per lb.)	17d.-17⅛d.	+1/⅛d.
ARMOURING:		
Galv. Steel Wire (0.104 in.)	50 10 0	—
Mild Steel Tape (0.04 in.)	40 0 0	—

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, London, W.C.2.

Electrotek of Cambridge Ltd. 85 Regent St., Cambridge. Manufacturers of mechanical and electrical equipment, etc. Cap.: £1,000. Dirs.: S. F. S. Whitehouse and W. G. Brunton.

J. R. Grace and Co. (Ryde) Ltd., 25 High St., Ryde, I.W. To take over business of wireless and television retailer and electrical engineer carried on at Ryde, I.W., by Joseph R. Grace. Cap.: £2,000. Dirs.: J. R. Grace and Mrs. D. C. H. Grace.

W. and F. Hallam and Co., Ltd. 139 Lee Rd., Blackheath, S.E.3. Electrical engineers and contractors, radio engineers, etc. Cap.: £3,500. Dirs.: W. Hallam and F. R. Hallam.

G. F. Hardwick Ltd., Waterdale, Doncaster. Manufacturers of and dealers in diesel engines, electrical engineers, etc. Cap.: £12,000. Dirs.: G. F. Hardwick and Phyllis Hardwick.

A. J. Hicks and Co., Ltd., Chorlton Terrace, Upper Brook St., Manchester, 13. Manufacturers and merchants of and dealers in linens, cottons, woollens and other fabrics; lampshades, table and standard lamps, and other electrical goods, etc. Cap.: £1,000. Dirs.: A. J. Hicks and Dorothy C. M. Hicks.

Hollisters (Electrical Contractors) Ltd., 3 Dover Rd., Northfleet, Kent. Cap.: £3,000. Dirs.: F. J. Hollister and R. M. Herivel.

Kingslake Motors. Ltd. 33 Kingslake St., Sheffield 9. Motor, aeronautical, electrical and general engineers, etc. Cap.: £1,000. Dirs.: C. Milnes, J. Burlison and Mrs. K. M. Milnes.

Lubbock and Smith Ltd., 106 King's Rd., Chelsea, S.W.3. Manufacturers of and dealers in radio and television sets and electrical appliances and fittings, etc. Cap.: £1,000. Dirs.: D. C. Lubbock, D. E. Smith, Barbara J. M. Lubbock and Ruby Zeitler.

Mayers (Insulations) Ltd., 24 Ford Rd., Bow, E.3. Pipe insulators for heat conservation and refrigeration, etc. Cap.: £500. Dirs.: J. Mayers and Elizabeth Mayers.

M.E.A.C. Ltd., 21 Newman St., W.1. Manufacturers of and dealers in general electrical and other equipment and appliances, including catering, domestic and household electrical equipment, etc. Cap.: £100. Dirs.: Louise M. Spreadbury, J. L. Florence and F. G. Williams.

M.R.M. Engineers (London), Ltd. 21a Barnsbury Park, N.1. Mechanical, research, experimental, manufacturing, electrical, electronic and general engineers, etc. Cap.: £300. Dirs.: J. E. Ginn and K. W. Hawes.

Oaklands Electric, Ltd. 421 Hatfield Rd., St. Albans, Herts. Electrical engineers and contractors, radio and television engineers, etc. Cap.: £2,000. Dirs.: C. H. Cunliffe and F. H. Moore.

Radio Activity Ltd. Manufacturers of and dealers in electric motors, transformers and dynamos, and electrical accessories, etc. Cap.: £4,000. Dirs.: not named. Subs.: W. F. Forster, 14 Hazel Rise, Hornchurch and A. W. Stripe, 39 Huddlestone Rd., Forest Gate, London, E.7.

BUSINESS PROSPECTS

HOME

Alloa. Plans approved for erection of senior secondary school.

Arbroath. All trades for erection of 50 houses on Hayshead site. Scottish Special Housing Assoc., 15-21 Palmerston Place, Edinburgh.

Barrow-in-Furness. Plans to be prepared for extensions to Central Library. Scheme for rebuilding public baths, to cost about £23,000, has been approved.

Bermondsey B.C. Quantity surveyors for construction of 35 flats on Wolseley site expected to be Davis, Belfield and Everest, 9 Ashley Place, S.W.1.

Boston (Lincs) R.D.C. Ministry approved erection of 60 houses at Wyberton, 16 at Swineshead and 38 dwellings on four other sites.

Cardiff T.C. It is proposed to renew wiring at City Hall. First stage estimated to cost £4,000.

Chanctonbury (Sussex.) R.D.C. Tenders to be invited for erection of 16 houses and 14 bungalows at Storrington.

Chester T.C. Schemes to be prepared for lighting new building at College of Further Education, Highfield junior school, and Highfield infants school.

Chigwell (Essex). Great West Hatch secondary technical school has been included in next year's building programme.

Cornwall. Included in 1954-55 programme is construction of first instalments of Falmouth and Wadebridge secondary schools and completion of Carclaze junior school.

Edinburgh T.C. Redevelopment scheme approved providing for 796 houses.

Falmouth T.C. Approval given to installation of electricity in all houses at present without supply.

Gateshead T.C. Shopping centres of about six shops each are to be built on Wrekenton, Beacon Lough and Lobley Hill estates. Plans prepared for 94 houses at Wrekenton.

Gillingham T.C. Erection of underground control centre for Medway C.D. Committee. Tenders invited for preliminary work. Borough Engineer and Surveyor, Municipal Buildings.

Gosport T.C. Total of 166 houses and two blocks of flats to be built at Rowner. Tenders to be invited in respect of first 116 houses.

Gravesend T.C. Construction of 60 houses on Westcourt estate. Borough Engineer and Surveyor, 6 Woodville Terrace.

Halifax T.C. Tenders to be invited shortly for erection of blocks of six shops each at Mixenden, Turner Ave., and Cousin Lane estates.

Harlow (Essex). Harlow Voluntary Aided primary; Tye Green and Latton Common junior and infants, and Voluntary Controlled infants and junior; and (second instalment of) Nettleswell secondary schools to be built next year.

Harrogate T.C. It is proposed to build 72 flatlets on Grove House estate.

Harwich. Tenders to be invited by C.C. for erection of Dovercourt Hill secondary school. Estimated cost, £216,050.

Kingston-on-Thames T.C. Construction of 105 flats on Chessington Hall estate. A. B. Rogers, town clerk.

Leicestershire. Approval granted for erection of Burbage secondary school at Hinckley (£151,000); and also a science block at Market Bosworth grammar school (£5,630).

Lexden and Winstree (Essex) R.D.C. It is proposed to build 74 houses at both Stanway and Tiptree, 18 at Boxted, and 22 on four other sites.

London. Estimate of £300,000 is before L.C.C. for provision of electric lifts on council's estates.

Lowestoft T.C. Concert hall is to be built on South Pier at estimated cost of £45,000. Also, 56 houses to be built on Gunton estate.

Middlesbrough. New church is to be erected at Saltersgill at cost of £25,000; architect is S. E. Dykes Bower, Quendon Court, Quendon, Essex. Also, tenders expected to be invited early next year for erection of 750 houses.

Newcastle-on-Tyne. G. H. B. Gray and Partners, Camden St., North Shields, are architects for primary school on Montagu estate.

Ossett (Yorks) T.C. During 1954, 22 houses to be built at Westfield, 10 in Radley St., and 8 at Kingsway.

Plymouth. Motor-car, and -cycle works, showrooms, offices, etc., to be built in Millbay Rd., by P. Pike and Co., Ltd. Architect is W. Roseveare, Sherwell House, Tavistock Rd.

Portslade (Sx.) U.D.C. Application to be made to borrow £50,224 for erection of 40 houses on Mile Oak site.

Rochdale T.C. Erection of secondary school at Spotland. Borough Surveyor, Town Hall.

Southwick (Sussex). Construction of 116 houses on Downs estate. Clerk to Council, Council Offices.

Romford T.C. Land at Gallows Corner will probably be purchased compulsorily to erect total of 193 dwellings.

Rotherham. Approval given to erection of primary school at Kimberworth Park, estimated to cost £91,473.

Salisbury T.C. Allocation of 179 houses received for 1954.

Southport. Ministry has approved development of Greaves Hall Mental Instn. for Liverpool Hospital Board. Estimated cost £2,850,000.

Stoke-on-Trent. Scheme for extensions to N. Staffs. Technical College, costing about £232,000, to be carried out next year.

Stone (Staffs) U.D.C. Erection of 68 dwellings on Lichfield Rd. site. Edward Forshaw and Greaves, architects, Old White Hart, Trinity St., Hanley.

Strabane U.D.C. Land is being acquired for erection of 200 houses at Ballycolman.

Twickenham T.C. Plans in hand for erection of 32 flats and 16 houses in Chertsey Road.

Wellingborough U.D.C. Erection of block of 12 shops, 8 maisonettes, 15 flats, etc., in Berrymoor Rd. Blackwell, Storry and Scott, architects, Gold St. Chambers, Kettering.

Worsborough (Yorks) U.D.C. Plans approved for extension of Everest Shoe Co. Ltd.'s factory in Station Rd., Worsborough Dale.

OVERSEAS

Saudi Arabia. It is reported that Messrs. Abdullah and Mahomed bin Ladin have approached Embassy concerning representation of U.K. manufacturers of electrical materials of all kinds, especially cables. Write to Fuad Zahid, c/o Messrs. Abdullah and Mahomed bin Ladin, Jedda.

MEETINGS TO NOTE

THURSDAY, NOV. 12

ENGINEERS' GUILD.—"Engineers' Guild—Purpose and Value." H. Nimmo, G. E. M. Godfrey and R. W. H. Couzens. Recruitment meeting at Caxton Hall, Westminster, 6 p.m.

I.E.E. (London).—Discussion on "Safety Precautions in Electronic Apparatus, especially Medical Applications." H. W. Swann and W. Grey Walter. Savoy Place, W.C.2, 5.30 p.m.

I.E.E. (N. Scotland).—"Electronic Telephone Exchanges." T. H. Flowers. Royal Hotel, Dundee, 7 p.m.

I.E.E. (Swansea).—"Electricity in Farm Crop-Drying." C. A. Cameron Brown. Public Library, Alexandra Rd., 6 p.m.

E.P.E.A. (Merseyside).—"H.V. Fault Location." D. J. A. Shirt and L. S. Herbert. Elect. Showrooms, Whitechapel, Liverpool, 7 p.m.

I.E.S. (Birmingham).—Ladies' Night at Queen's Hotel.

I.E.S. (Manchester).—Members' Night at Elect. Board, Town Hall Extension, 6 p.m.

I.E.S. (Nottingham).—"TV Studio Lighting." D. C. Lightbody. Elect. Board, Smithy Row, 6 p.m.

I.E.S. (Bradford).—"New Lamps, New Uses and New Techniques." H. R. Ruff. Y.E.B., 45-53 Sunbridge Rd., 7.30 p.m.

FRIDAY, NOV. 13

A.S.E.E. (Stoke and Crewe).—"Applications of Pyrotenax." H. J. Hansen. Copeland Arms Hotel, Stoke, 7.30 p.m.

E.I.B.A.—Annual dinner and ball at Grosvenor House, London.

I.E.E.(N.W.Utilisation).—Dinner-dance at Lesser Free Trade Hall, Peter St., Manchester, 7 p.m.

I.E.E. (S.W. Scotland).—"Nuclear Reactors and their Applications." Sir John Cockcroft, 39 Elmbank Crescent, Glasgow, 7 p.m.

SOC. OF CHEMICAL INDUSTRY (Corrosion Group).—Symposium on Cathodic Protection. I.E.E., Savoy Place, W.C.2, 9.45 a.m.

ASSOC. ELECTRICAL MACHINERY TRADES.—Annual dinner at Savoy Hotel, London.

MONDAY, NOV. 16

I.E.E. (London).—Discussion on "Illuminations and Decorative Lighting." H. Carpenter. Savoy Place, W.C.2, 5.30 p.m.

I.E.E. (Mersey and N. Wales).—"Telemetering for System Operation." R. H. Dunn. Town Hall, Chester, 6.30 p.m.

I.E.E. (N.E. Radio and Measurements).—"Method of Designing Transistor Trigger Circuits." Prof. F. C. Williams and G. B. Chaplin. King's College, Newcastle 6.15 p.m.

BIRMINGHAM ELECTRIC CLUB.—"Radiology." Dr. J. F. Brailsford.

B.E.A.M.A.—Annual dinner at Grosvenor House, London.

TUESDAY, NOV. 17

I.E.E. (London Measurements).—"A.C. Instrument Testing Equipment." A. H. M. Arnold. Savoy Place, W.C.2, 5.30 p.m.

I.E.E. (E. Midlands).—"Diesel Electric Locomotives." G. E. Smith. Electricity Showrooms, Derby, 6.30 p.m.

I.E.E. (E. Midlands).—"Electricity applied to Mining." C. D. Wilkinson. University Arms Hotel, Cambridge, 7 p.m.

I.E.E. (N. Midland Utilisation).—"Technique and Development of Automatic Winding in Mine Shafts." B. L. Metcalfe and G. Cuttle. B.E.A., Yorks. Div., 1 Whitehall Rd., Leeds, 6.30 p.m.

I.E.E.—Scottish Centre dinner-dance at Grosvenor Restaurant, Glasgow, 6 p.m.

I.E.E. (Rugby).—"Design Features of Certain British Power Stations." S. D. Whetman and A. E. Powell. College of Technology and Arts, 6.30 p.m.

A.S.E.E. (London).—"Electrical Developments in Horticulture." F. E. Rowland. Magnet House, Kingsway, W.C.2

I.E.S. (Liverpool).—"Lamps and Lighting for Inspection." H. E. Bellchambers. Elect. Showrooms, Whitechapel, 6 p.m.

WEDNESDAY, NOV. 18

INST. OF FUEL (Yorks).—"Recovery and Use of Rejected Heat in Industry." S. J. Eardley. The University, Leeds, 6.30 p.m.

I.E.E. (Sheffield).—"Assessment of Impregnated Pressure Cable." L. G. Brazier, D. T. Hollingsworth and A. L. Williams. Grand Hotel, 6.30 p.m.

I.E.E. (N. Scotland).—Chairman's address by R. S. Goddard. Caledonian Hotel, Inverness, 7.30 p.m.

I.E.E. (Oxford).—"Control of National Grid." P. J. Squire. Elect. Board, 37 George St., 7 p.m.

I.E.S. (Manchester).—Annual dinner at Cafe Royal.

I.E.S. (Huddersfield).—"Maintenance of Fluorescent Lighting Installations." W. A. R. Stoyle. 19/23 Northgate, Halifax, 7.30 p.m.

I.E.S. (N. Lancs).—"Glass and Lighting Industry." P. M. Davidson. Elect. Board, 19 Friargate, Preston, 7.15 p.m.

I.E.S. (Tees-side).—"Principles and Applications of Photo-Electric Cells." S. Rodda. Cleveland Scientific and Tech. Inst., Corporation Rd., Middlesbrough, 6.30 p.m.

INCORP. PLANT ENGRS. (Glasgow).—"Heat Transfer." R. A. Brecknell. Building Centre, Sauchiehall St., 7 p.m.

A.S.E.E. (S.W. London) Branch lecturettes at Guild House, 32 Worple Rd., Wimbledon, 8.15 p.m.

A.S.E.E. (Nottingham). "Master and Slave Clock Systems." E. O. Chapman. Elect. Board, Smithy Row, 7.30 p.m.

A.S.E.E. (Manchester). "Recent Developments of Colour TV." Dr. J. A. Darbyshire. Engineers' Club, Albert Sq., 7.30 p.m.

THURSDAY, NOV. 19

A.S.E.E. (Kent). "Electrical Installations in Large Buildings." W. F. Parker. Bridge Cafe, 32 High St., Tonbridge, 8.p.m.

I.E.E. (London Utilisation).—"Wear of Carbon Brushes at High Altitudes." R. F. Sims. Savoy Place, W.C.2, 5.30 p.m.

I.E.E. (E. Midlands).—"Electricity in Farm Crop Drying." C. A. Cameron Brown and P. G. Finn-Kelcey. George Hotel, Kettering, 7.30 p.m.

I.E.E. (S. Midland).—"Printed and Potted Electronic Circuits." G. W. A. Dummer and D. L. Johnston. Winter Gardens Restaurant, Malvern, 7.15 p.m.

I.E.E. (Irish).—"Co-ordination of Insulation of High-Voltage Electrical Installations." J. S. Cliff. Trinity College, Dublin, 6 p.m.

INCORP. PLANT ENGRS. (Blackburn).—"Electrical Hazards." D. A. Picken. Grosvenor Hotel, 7.30 p.m.

FRIDAY, NOV. 20

INSTN. OF MECHANICAL ENGRS.—Thomas Hawksley lecture on "Relaxation Methods." Sir Richard Southwell. Storey's Gate, S.W.1, 5.30 p.m.

I.E.E. (N. Midland).—Annual dinner, Queen's Hotel, Leeds, 7 p.m

I.E.E. (N. Staffs).—Annual dance at Crown Hotel, Stone, 8.30 p.m.

EXHIBITION DIARY

Fuel Efficiency.—To be held in Manchester between Nov. 18 and 28.

Building.—To be held at Olympia, London, between Nov. 18 and Dec. 2.

TRADE NOTES

New Showrooms. The Kenwright Electrical Co. Ltd., Wholesalers, have opened a new demonstration showroom at their premises at 515 London Rd., Thornton Heath, Surrey.

Mark of Origin. The U.K. Trade Commissioner at Bombay states that a number of U.K. manufacturers are not marking their goods with the country of origin in accordance with the Indian Merchandise Marks Act. The goods covered include electrical apparatus and appliances, lamp bulbs, batteries and torches.

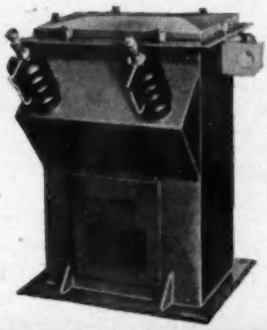
Change of Name. The name of Rushtons (Leeds) Ltd. has been changed to Roundhay Metal Finishers (Leeds) Ltd. The address remains Olympia Works, Roundhay Rd., Leeds.

Distributors. Chamberlain Industries Ltd. have appointed Electricals Ltd., 14 Claremont Place, Newcastle-upon-Tyre 2, as their main distributors and stockists for "Staffa" products.

Change of Address. As from November 23, the address of the Bristol branch of British Insulated Callender's Cables Ltd. will be: 7-9 Barton St., Bristol. Phone number: Bristol 23453.

HACKBRIDGE
TRANSFORMERS

One of two 3-phase 132/66/11kV. Hackbridge Transformers at a substation in Australia



HACKBRIDGE Transformers are backed by long and varied experience in the design and manufacture of transformers of every type, size and voltage — for supply, distribution and industrial applications. Also on-load voltage regulating equipment, reactors, arc-suppression coils and high-grade instrument transformers.

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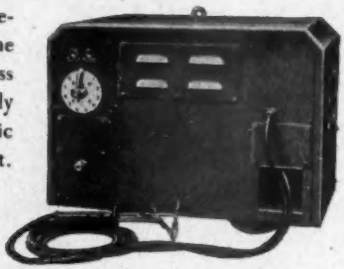
. . . just the job for M-V Atomic Hydrogen welding equipment

Broken shanks of drills and reamers, fractured collets and a whole host of other workshop production tools can be repaired with M-V atomic hydrogen welding equipment. The same equipment is also used for the manufacture of press tools, by depositing tool steel on mild steel blanks exactly where required. Full technical details of the M-V atomic hydrogen welder and its applications are available on request.

Metrovick Atomic Hydrogen Welding Equipment, comprising 50 ampere Welding Set and Torch connected by cable and pipe.



METROPOLITAN-VICKERS ELECTRICAL COMPANY LIMITED, TRAFFORD PARK, MANCHESTER, 17
Member of the A.E.I. group of companies

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J/E004

CLASSIFIED ADVERTISEMENTS

OFFICIAL TENDERS AND APPOINTMENTS

WORK WANTED WANTED · FOR SALE

Those wishing to advertise in these pages should send the text to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London W.C.2, before 10 a.m. on TUESDAY of week of issue. Official Displayed Advertisements are charged at 42s. per inch, and all other classified advertisements at 3s. per line. Situations Wanted will be published four times for twice the single insertion rate. Fee for Box No. and postage on replies is 2s.

TENDERS INVITED

BOROUGH OF WREXHAM

GROUP "A" AND "BV STREET LIGHTING

TENDERS are invited for the supply only of the following items: 20 No. steel columns and brackets having a mounting height of 25 ft; 160 No. steel or cast iron columns and brackets having a mounting height of 15 ft; 60 No. concrete columns and brackets having a mounting height of 15 ft; 20 No. 250 W mercury vapour lanterns; 50 No. 125 W mercury vapour lanterns; 170 No. 100 W tungsten lanterns.

Drawings and conditions of contract may be inspected at the office of the Borough Engineer and Surveyor, 31 Chester Street, Wrexham, from whom copies of the specification and forms of tender may be obtained on payment of a deposit of two guineas, which will be refunded on receipt of a bona-fide tender.

Tenders, in the appropriate plain envelope, sealed and endorsed "Street Lighting," should reach the undersigned not later than first post on Monday, November 16, 1953.

The Council do not bind themselves to accept the lowest or any tender.

PHILIP J. WALTERS,
Town Clerk.

Guildhall,
Wrexham.
October 28, 1953. (F 496)

EGYPTIAN GOVERNMENT

TENDERS are called for by the Director General, Cairo Electricity & Gas Administration, for the supply, erection and installation of SWITCHING AND TRANSFORMER SUBSTATIONS and the associated cable system for Cairo International Airport and territory.

Tenders should be submitted to:
The Director General,
Cairo Electricity & Gas Administration,
53 Fouad El Awal Street,
Cairo, Egypt
not later than noon on November 28, 1953.

Copies of the necessary conditions of tender specification, etc., can be obtained on application to the Chief Inspecting Engineer, Egyptian Government, 41 Tothill Street, London, S.W.1, against remittance of £3 1s. 6d. per set, which sum must be prepaid and is not returnable. Copies of these documents are also available for scrutiny at the above address. Cheques must be endorsed permitting transfer to an Egyptian Government account.

Reference No. 44/Elect. & Gas 3/2/582 must be quoted in all correspondence. (F 554)

COUNTY BOROUGH OF ST. HELENS

STREET LIGHTING

TENDERS are invited for the supply, erection and wiring of 50 25-ft. Mounting Height CONCRETE STANDARDS, complete with 250 W new restricted cut-off type H.P.M.V. Lanterns, and 4 15-ft. Mounting Height Concrete Standards complete with 125 W H.P.M.V. Lanterns.

Forms of Tender, Specifications, etc., may be obtained from the undersigned on payment of a deposit of £2 2s., which will be returned on receipt of a bona fide Tender.

No Tender will be received except on the Tender Form and sealed in the endorsed envelope provided.

Tenders must be delivered to the Town Clerk, Town Hall, St. Helens, not later than Monday, November 30, 1953.

The Corporation do not bind themselves to accept the lowest or any Tender.

M. WARD, M.I.Mun.E.,
Borough Engineer.

Town Hall,
St. Helens.
November 3, 1953. (F 557)

BOROUGH OF DOVER

STREET LIGHTING—TRUNK ROAD A.2

QUOTATIONS are invited for the supply and delivery of 151 sets of LANTERNS, with 400 W H.P.M.V. LAMPS, GEAR, TIME-SWITCHES, etc., all to Group A lighting standard.

A copy of the specification may be obtained from the Borough Engineer, Brook House, Dover.

Quotations, in envelopes provided, must be delivered to the undersigned not later than November 30, 1953.

JAMES A. JOHNSON,
Town Clerk.

New Bridge House,
Dover.
November 6, 1953. (F 555)

BOROUGH OF DOVER

STREET LIGHTING—TRUNK ROAD A.2

TENDERS are invited for the INSTALLATION of a lighting scheme to Group A standard. The works include the supply and erection of 122 steel columns and 29 reinforced concrete columns, the fixing only of H.P.M.V. units and auxiliary equipment, and the complete wiring for same.

Plans and general conditions of contract may be inspected on application to the Borough Engineer, Brook House, Dover, and specification and form of tender may be obtained from him upon payment of a deposit of £2 2s., returnable on receipt of a bona fide Tender not subsequently withdrawn.

Sealed tenders, in envelopes provided, must be delivered to the undersigned not later than November 30, 1953.

JAMES A. JOHNSON,
Town Clerk.

New Bridge House,
Dover.
November 6, 1953. (F 556)

CITY OF BELFAST

Electricity Department

CIRCULATING WATER SCREENING PLANT

TENDERS are invited for the supply, delivery and erection of circulating water screening plant at the Municipal Electric Power Station East, Belfast.

Form of tender and specification (No. W.22) may be obtained at the Electricity Department, East Bridge Street, Belfast, on payment of a deposit of two guineas which will be refunded provided a bona fide tender is lodged and not withdrawn. Extra copies may be obtained at one guinea each; this sum will not be returnable. Cheques should be made payable to the Belfast Corporation Electricity Department.

Each tender, in sealed envelope marked "Tender for Circulating Water Screening Plant, Electricity Committee," and endorsed with the name and address of the tenderer, must reach the undersigned not later than 4 p.m. on Friday, December 4, 1953.

An official receipt must be obtained for each tender delivered by hand. Tenders sent by post should be registered.

The lowest or any tender will not necessarily be accepted.

JOHN DUNLOP,
Town Clerk.

City Hall,
Belfast.
November 6, 1953. (F 506)

BOROUGH OF BARKING

STREET LIGHTING

TENDERS, returnable on November 30, 1953, are invited for the supply and erection of 46 STREET LIGHTING COLUMNS Group A standard, with 400 W MA/V lamps, lanterns and all auxiliary equipment completed for street lighting services.

The general conditions of contract, specifications and form of tender may be obtained from the Borough Engineer and Surveyor, Town Hall, East Street, Barking.

The Council does not bind itself to accept the lowest or any tender. (F 553)

METROPOLITAN BOROUGH OF WANDSWORTH

CABLE

TENDERS are invited for the SUPPLY of armoured and twin rubber covered cable.

Specifications, etc. can be obtained on application to the Borough Engineer and tenders must be delivered to me by noon, Wednesday, November 25, 1953.

R. H. JERMAN,
Town Clerk.

Municipal Buildings,
Wandsworth, S.W.18. (F 598)

CITY OF SALFORD

Baths and Wash-houses Department

TENDERS are invited by noon on December 7, 1953, for the Slipper Baths CALL SYSTEM INSTALLATION (ELECTRICAL) required for FOUR Bathing Establishments in the City.

Specification, conditions, drawings and form of tender may be obtained from the General Superintendent, Administrative Offices, Blackfriars Public Baths, Salford 3.

Tenders to be forwarded to the undersigned in plain sealed envelopes endorsed "Baths Establishments—Call System Installation."

H. H. TOMSON,
Town Clerk.

Town Hall,
Salford 3. (F 599)

APPOINTMENTS VACANT

Engagement of persons must be made through a Local Labour Office or Scheduled Employment Agency, if the applicant is a man aged 18-64, or a woman aged 18-59; unless the person concerned is excepted or the employment is in a managerial or professional capacity, or is otherwise excepted from the provisions of the Notification of Vacancies Order, 1952.

KENT COUNTY COUNCIL

APPLICATIONS are invited for the appointment in the Buildings Department of two ENGINEERING INSPECTORS at a salary in A.P.T., Grade V(a) (£625/£685).

Applicants must have had good practical experience in the design and installation of equipment in one or more of the following, viz.: (a) electrical installations for buildings; (b) low pressure hot water heating and domestic hot and cold water systems; (c) steam services associated with heating and cooking installations.

Preference will be given to members of the Institution of Heating and Ventilating Engineers or the Institution of Electrical Engineers.

Applications, on forms obtainable from the County Architect, Springfield, Maidstone, must be delivered to him within fourteen days of the appearance of this advertisement.

W. L. PLATTS,
Clerk of the County Council.

County Hall,
Maidstone.
November 2, 1953. (F 565)

BRITISH ELECTRICITY AUTHORITY

North Eastern Division

APPLICATIONS are invited for the appointment of STATION CHEMIST at Darlington Power Station.

Applicants should have had experience in modern power station laboratories covering the analysis of fuel water and oil and be conversant with water treatment and fuel sampling. A University Degree in Chemistry or A.R.I.C. is preferable, but candidates with a Higher National Certificate in Chemistry followed by a recognised course of study will be considered.

The salary for this appointment will be in accordance with the National Joint Board Agreement, Schedule "A," Grade 7, Class "F" (£697 to £718 per annum.

Forms of application may be obtained from Divisional Establishments Officer, British Electricity Authority, North Eastern Division, Carliol House, Newcastle-upon-Tyne, to whom they should be returned to arrive not later than November 21, 1953. (F 546)

SOUTH WESTERN ELECTRICITY BOARD

VACANCY for SENIOR DRAUGHTSMAN in Torbay District, Devon Sub-Area. Salary within N.J.B. D.5 (£547/£671 p.a.). Duties include supervision of District Drawing Office. Knowledge of o/h line design essential. Possession of H.N.C. in Elec. Eng. desirable. Apply on Form AE.6/ACT, obtainable from District Manager, Electric House, Union Street, Torquay, by November 28, 1953. (F 567)

HER MAJESTY'S COLONIAL SERVICE

THE FOLLOWING vacancies exist for Electrical Engineers in Nyasaland.

GENERATION ENGINEER
(CDE 145/4/01) Nyasaland

Duties include maintenance and operation of steam power and diesel plant. Commencing salary of between £975 and £1,245, in the scale £695 to £1,515 per annum to suitably qualified and experienced candidate, plus cost-of-living allowance of approximately 13%.

Appointment will be on three years' probation for pensionable employment. Free passages, once each way each tour, to officer, his wife, and children up to the cost of one adult passage. Quarters, if available are provided at low rent and leave is granted at the rate of five days for each month of service after a tour of two to three years.

Candidates, not over 40 years of age, should be Corporate Members of one or more of the recognised engineering institutions and should be familiar with the operation and maintenance of modern medium pressure steam power plant.

DISTRIBUTION ENGINEER
(CDE 145/4/01) Nyasaland

Duties include maintenance and operation of steam power and diesel plant. Salary scale £695 to £1,245 per annum increasing to £1,515 if officer appointed holds A.M.I.E.E., plus cost-of-living allowance of approximately 13%, the point of entry being determined by War Service and experience.

Appointment will be on three year's probation for pensionable employment. Free passages, once each way each tour, will be granted to the officer, his wife, and children up to the cost of one adult passage. Quarters if available, are provided at low rent and leave is granted at the rate of five days for each month of service after a tour of two to three years.

Candidates between 23 and 27 years of age should have passed or be exempt from Sections "A" and "B" of the Associate Membership Examination of the Institution of Electrical Engineers and should have had experience in an electricity supply undertaking, with particular emphasis on distribution. Power station experience an advantage.

Apply, in writing, to the Director of Recruitment, Colonial Office, Great Smith Street, London, S.W.1, giving briefly age, qualifications and experience. Mention the reference number shown against the post applied for. (F 547)

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:

GENERAL ASSISTANT DISTRICT ENGINEER
Leominster District,
Shropshire and Herefordshire Sub-Area.

Experience necessary in all branches of distribution work, including operation and maintenance of high and low voltage cables and overhead lines, substations, etc. Technical qualifications desirable. Salary £468 to £490 p.a. (N.J.B. Grade B.10).

JUNIOR ENGINEER
Hereford District,
Shropshire and Herefordshire Sub-Area.

Experience desirable in all branches of distribution work, including erection of h.v. and l.v. overhead lines and substations. Technical qualifications desirable. Commencing salary £390 p.a. (N.J.B. "Class E," Grade 15)

WAYLEAVE OFFICERS
Hereford and Wellington,
Shropshire and Herefordshire Sub-Area.

Duties include the survey and plotting of routes for proposed overhead lines, and the negotiating of wayleaves. Technical qualifications desirable. Salary £460 to £520 p.a. (N.J.C. Grade 2).

Apply, in writing, within 14 days, stating age, experience, present position and salary to Sub-Area Manager, Midlands Electricity Board, Ditherington, Shrewsbury.

A. STEPHENS,
Secretary.
(F 585)

BRITISH ELECTRICITY AUTHORITY

Merseyside and North Wales Division

JUNIOR ENGINEER (Lab) required for the Bromborough Power Station. Salary £424 to £516 per annum. N.J.B. Class "H," Grade 16/14. Superannuable and subject to medical examination. Applicants should have a sound practical training in chemical laboratory work preferably in the analysis of oil, water and coal. Possession of Higher National Certificate or equivalent qualifications would be an advantage. Application forms from the Divisional Secretary, Beaconsfield Road, Woolton, Liverpool. Closing date: November 20, 1953. (F 603)

YORKSHIRE ELECTRICITY BOARD

No. 7 (Grimsby) Sub-Area

SENIOR ASSISTANT ENGINEER
(Distribution Design)

CANDIDATES should preferably be Corporate Members of the Institution of Electrical Engineers or hold equivalent qualifications. The successful candidate will be responsible to the Sub-Area Engineer for the design of H.V. and L.V. Overhead and Underground distribution networks and substation plant, the preparation of relevant technical reports, and the assessment of load growth on all existing substation networks operating at voltages up to 66 kV.

Salary: N.J.B. Class "G," Grade 4, £905/£944 per annum.

Grimsby District
DEMONSTRATOR

Applicants must have had two years domestic science training at a recognised College, and have obtained the E.A.W. Certificate. Previous experience of demonstrating to the public will be an advantage. The person appointed will be located at Grimsby, but will be required to work throughout the Sub-Area as occasion demands.

Salary: N.J.C. Grade 1, £390/470 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 7 (Grimsby) Sub-Area, Yorkshire Electricity Board, Moss Road, Grimsby, not later than November 26, 1953.

No. 3 (Sheffield) Sub-Area

Rotherham/Mexborough District
INSTALLATION ENGINEER

Applicants should possess a sound technical training, having served a full apprenticeship with a recognised firm of Electrical Contractors and subsequently have had a wide experience of all classes of electrical contracting work covering installations for lighting, heating and power, including modern methods of estimating and tendering.

Details should be given of experience in the following matters:—

Preparation of specifications, estimates and tenders for all classes of installation work including heavy industrial power installation work. Application of I.E.E. Wiring Regulations covering electrical contracting work. Maintenance and repair work on electrical plant and machinery. Layout and supervision of installations on site. Control of staff and workpeople. Adminstration.

Salary: N.J.B. Class "J," Grade 8, £764/£796 per annum.

Sub-Area Headquarters
GENERAL ASSISTANT ENGINEERS
(Construction and Maintenance) (Two Posts)

Applicants should hold the Higher National Certificate in Electrical Engineering, and should have had experience on electrical distribution, preferably on overhead line systems up to 66 kV, and/or on underground cable systems up to 33 kV. Both mains and substation experience is desirable.

Salary: N.J.B. Class "N," Grade 13, £692/£716 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Commercial Street, Sheffield, not later than November 26, 1953.

No. 4 (Leeds) Sub-Area

Leeds District
ASSISTANT CONSUMERS' ENGINEER
(Morley)

Applicants should be Corporate Members of the Institution of Electrical Engineers or hold qualifications leading to such membership, and must have had a sound training and subsequent experience in the work of a Consumers' Department in an Electricity Undertaking.

Details should be given of experience in the following matters:—

Negotiations with consumers requiring electricity supplies, tariffs, sales development, application of I.E.E. Wiring Regulations and other relevant regulations in testing and inspecting consumers' installations, electrical installation work. Control of staff and workpeople.

Salary: N.J.B. Class "J," Grade 10, £690/£706 per annum.

Leeds District
GENERAL ASSISTANT DISTRICT ENGINEER
(Leeds North East)

Applicants should be graduate members of the Institution of Electrical Engineers and have experience in the construction, planning, operation and maintenance of overhead and underground distribution systems, the latter in a densely populated industrial and residential area.

The successful applicant will be required to reside within the district and to undertake standby duties on occasion.

Salary: N.J.B., Class "J," Grade 11, £639/£665 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 4 (Leeds) Sub-Area, Yorkshire Electricity Board, Bramhope, Leeds, not later than November 26, 1953.

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No. 1 (Bradford) Sub-Area

Bradford District
ASSISTANT COMMERCIAL ENGINEER
(Street Lighting)

Applicants should have had a sound technical training with particular emphasis on public lighting. They should also have considerable experience in the operation of a department concerned with the erection and subsequent maintenance of public lighting installations, and should be able to plan new schemes, and prepare estimates for such schemes.

General experience of public lighting records systems is also desirable.

Salary: N.J.B., Class "H," Grade 10, £641/£667 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 1 (Bradford) Sub-Area, Yorkshire Electricity Board, 45-53 Sunbridge Road, Bradford, not later than November 26, 1953.

No. 5 (Wakefield) Sub-Area

Castleford District
GENERAL ASSISTANT DISTRICT ENGINEER

Applicants must have had a sound practical training with experience in the construction, operation and maintenance of h.v. and l.v. overhead and underground distribution networks, substation plant and ancillary equipment.

Applicants must hold a current driving licence, be prepared to reside in the district and undertake standby duties.

Preference will be given to those who are Corporate Members of the Institution of Electrical Engineers or who hold equivalent qualifications.

Salary: N.J.B., Class "E," Grade 11, £594/£640 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a Denby Dale Road, Wakefield, not later than November 26, 1953.

(F 583)

CITY COUNCIL OF SINGAPORE

City Electrical Engineer's Department

ASSISTANT RESIDENT MECHANICAL ENGINEER
Pasir Panjang Power Station.

APPLICATIONS are invited for the post of Assistant Resident Mechanical Engineer for the Pasir Panjang Power Station, which is at present in operation with two 25MW turbo-alternators and two 187,500 lb per hour boilers 625 lb/sq in. pressure and 825 deg. F. superheat, and for which extensions are now in hand covering three 25MW turbo-alternators, five 187,500 lb/hr boilers, and one 2 MW gas turbine house set.

Applicants should be Corporate or Graduate Members of one of the Senior Engineering Institutions or possess equivalent qualifications, and have had a sound training in mechanical and electrical engineering with practical experience in steam power plant and ancillary equipment.

The appointment is for a two years' agreement commencing in April, 1954, at a salary of $1,450 per month, inclusive of transport allowance ($1.00=2s. 4d.).

Free first-class return passages by normal route for the officer, his wife and children up to three full passages in all, provided no child exceeding the age of 12 years will receive a passage.

Half salary from the date of leaving the United Kingdom to the arrival in Singapore and on the return voyage.

Vacation leave of 28 days after completion of two years' resident service to commence from the date of arrival in the United Kingdom provided the return voyage does not exceed 26 days.

Rent of City Council quarters, if available, $50 per month.

Applications, endorsed "Assistant Resident Mechanical Engineer" stating age, qualifications and experience, should be forwarded to the undersigned within 14 days of the date of this advertisement.

PREECE, CARDEW AND RIDER,
Consulting Engineers.
8, 10 and 12 Queen Anne's Gate,
Westminster, London S.W.1. (F 602)

BRITISH ELECTRICITY AUTHORITY

Southern Division

S/13.459

APPLICATIONS are invited for a position as:
OPERATION AND MAINTENANCE ENGINEER
High Wycombe Generating Station

Applicants should preferably have had experience in the operation and maintenance of a generating station and in staff administration.

Salary: Class "A," Grade 5, £562 to £604.

Special application forms, obtainable from P. D. A. Oliver, Divisional Secretary, 111 High Street, Portsmouth, should be returned by November 25, 1953. (F 594)

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

APPLICATIONS are invited for the following positions within the Division:

CIVIL ENGINEERING DRAUGHTSMEN
Construction Department. Vacancy No. 22/53.

Candidates should have experience in design and detail of reinforced concrete structures, piled and slab foundations for heavy plant, culverts, cable subways, etc., for general building construction drainage and sanitation schemes, associated with office and administrative buildings.

The salary will be in accordance with Grade 5 (£567 to £671 per annum) or Grade 6 (£433 to £567 per annum) of Schedule "D" of the National Joint Board Agreement.

ENGINEERING DRAUGHTSMEN (MECHANICAL)
Construction Department. Vacancy No 44/53.

Senior Draughtsmen are required in the Mechanical Section of the Construction Department at North Wilford Power Station. Candidates should have experience in one or more of the following:

1. Design and layout of power station equipment, including turbo-alternators, boiler plant, coal and ash plant, and general station auxiliaries.
2. H.P. and L.P. steam and feed pipework. Condensing plant and feed heating systems.
3. Conveyor plant, coal handling systems and material handling of station auxiliary equipment.

Salary and conditions of service will be in accordance with the National Joint Board Agreement Grade 5 (£567 to £671 per annum) and Grade 6 (£433 to £567 per annum) of Schedule "D" according to experience.

ENGINEERING DRAUGHTSMEN (ELECTRICAL)
Construction Department. Vacancy No. 61/53.

Candidates should have experience in the preparation of layouts and diagrams for the installation of E.H.T. and L.T. switchgear, transformers, E.H.T. and L.T. cables; knowledge of protective gear systems would be an advantage.

The salary will be in accordance with Grade 5 (£567 to £671 per annum) or Grade 6 (£433 to £567 per annum) of Schedule "D" of the National Joint Board Agreement.

FIRST ASSISTANT CHEMIST
Burton-on-Trent Power Station. Vacancy No. 125/53.

Applicants should preferably possess the Higher National Certificate in Chemistry or its equivalent. They should have had practical experience in the analysis of coal, water and oil, etc., in so far as they concern power station requirements and will be directly responsible to the Group Chemist.

The salary for the above appointment will be as National Joint Board Schedule, Class "E", Grade 9 (£567 to £600 per annum).

The closing date for this appointment will be November 19, 1953.

THIRD ASSISTANT ENGINEER (ELECTRICAL)
Generation Construction Department, Div. H.Q.
Vacancy No. 127/53.

Applicants should be fully conversant with contract procedure and have had a fundamental training in electrical engineering, including workshops, and should preferably have had experience in the manufacture, erection, maintenance and operation of switchgear transformers, electrical auxiliaries, main and multi-core cable work, and lighting and heating installations for large power stations. Preference will be given to candidates who possess a university degree or equivalent qualification in electrical engineering.

The salary for the appointment will be within Schedule "C", Class "AX/DX", Grade 5 (£649 to £858 per annum) of the National Joint Board Agreement.

The closing date for this appointment will be November 19, 1953.

SHIFT CHARGE ENGINEER
Avon Power Station. Vacancy No. 126/53.

Applicants should have had a sound technical training and experience in a modern generation station. The possession of a Higher National Certificate in Mechanical or Electrical Engineering or equivalent qualifications, will be advantageous.

The salary for this appointment will be in accordance with Class "E", Grade 7 (£649 to £681 per annum) of the National Joint Board Agreement.

The closing date for this appointment is November 19, 1953.

GENERAL ASSISTANT ENGINEER
Technical Department, Div. H.Q. Vacancy No. 132/53

The minimum technical qualification is Higher National Certificate but a degree in electrical engineering is preferred for the Divisional Headquarters vacancy.

Applicants must have experience of the operation and maintenance of switchgear and protective gear.

The salary will be in accordance with Schedule "C", Class "AX/DX," Grade 8 (£501 to £694) per annum of the National Joint Board Agreement.

The closing date for this appointment will be November 26, 1953.

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THIRD ASSISTANT ENGINEER
Transmission Department, Div. H.Q. Vacancy No. 133/53.

Preference will be given to applicants who are graduates of the Institution of Electrical Engineers or hold equivalent qualifications. They are also required to have had a sound engineering training and subsequent experience in the maintenance and operation of 132 kV overhead lines, transformers and switchgear.

The salary will be within Schedule "C", Class "AX/DX," Grade 5, (£649 to £858 per annum) of the National Joint Board Agreement.

The closing date for this appointment will be November 26, 1953.

JUNIOR ENGINEER
Avon Power Station. Vacancy No. 134/53.

Applicants should possess the Higher National Certificate in engineering and have had operating experience in a steam power station. The duties will include assisting in testing of plant, maintenance of instruments and in the technical work of the station.

Salary for this appointment is £445 per annum within Class "E," Grade 14, of the National Joint Board Agreement.

The above positions will be pensionable within the provisions of the British Electricity Authority and Area Boards Superannuation Scheme.

Applications should be submitted on the official form which may be obtained from the Divisional Establishments Officer, British Electricity Authority, Barker Gate, Nottingham, and should be returned to the undersigned by the dates stated. Please quote vacancy number.

L. F. JEFFREY,
Divisional Controller.
(F 567)

CITY OF BELFAST

Electricity Department

APPLICATIONS are invited for the position of JUNIOR ASSISTANT TECHNICAL ENGINEER

Applicants must have a University Degree in Electrical Engineering or be Corporate Members of the Institution of Electrical Engineers. They must have a sound engineering training. They must not be more than 35 years of age on the date of taking up the appointment.

The weekly wages for the position are equivalent to Grade 13, Class "H," of the Northern Ireland Joint Board Schedule of Salaries for Technical Engineers on the staff of authorised undertakings. The scale is at present £523 per annum for the first two years, £533 for the third and fourth years, and £542 after the fourth year. Upon the completion of 12 months' satisfactory service the successful applicant will be established on the salary list. The employment shall be terminable during the first 12 months by one week's notice and thereafter by one calendar month's notice on either side. Superannuation contributions will be payable at the rate of approximately 6 per cent. of remuneration.

Applications, which must be made on the official form obtainable from the Electricity Department, East Bridge Street, Belfast, must reach the undersigned not later than 4 p.m. on Friday, November 27, 1953.

Canvassing in any form, oral or written, direct or indirect, will, if proved to the satisfaction of the appointing authority, disqualify a candidate for appointment.

JOHN DUNLOP,
Town Clerk.

City Hall,
Belfast.
November 5, 1953. (F 579)

BRITISH ELECTRICITY AUTHORITY

South West Scotland Division

DEPUTY POWER STATION SUPERINTENDENT
Braehead Generating Station

APPLICATIONS are invited for the position of Deputy Power Station Superintendent at Braehead Generating Station, Renfrew. The salary will be in accordance with Class "H" Grade 3 of the National Joint Board Agreement for the Electricity Supply Industry.

Applicants are required to hold at least the minimum qualification of the Higher National Certificate in Engineering and membership of the Institution of Mechanical or Electrical Engineers would be an advantage together with experience in the operation of pulverised fuel plant. The successful applicant will be responsible to the Station Superintendent for the efficient operation and maintenance of the Station and should have had experience in the administrative duties involved in the organisation and supervision of power station employees.

Applications on form AE.6 may be obtained from the Authority's Headquarters or from any Divisional Office of the Authority and should be forwarded to the Divisional Secretary, 169 Broomhill Drive, Glasgow, W.1, before Saturday, November 28, 1953.

A. CHRISTIANSON,
Divisional Secretary.
(F 561)

SOUTH EASTERN ELECTRICITY BOARD

SENIOR SHOWROOM ASSISTANT
West Kent District.

SALARY of £460 by £20 to £520 p.a. plus London Weighting under N.J.C. Grade 2. Superannuable. Applicants should be experienced in general showroom duties including advice to consumers on choice of apparatus, tariffs, and consumers service. They should also be able to promote sales.

Applications, on forms obtainable from District Managers or Senior Officers, must reach P. S. Watson, M.I.E.E., West Kent District Manager, SEEBoard, 270 High St., Orpington, Kent, by November 23, 1953.

ASSISTANT DISTRICT COMMERCIAL ENGINEER
Brighton and Hove District.

Salary £729 to £758 p.a. under N.J.B. Schedule, Class "G," Grade 7. Superannuable. Applicants must be experienced in the organisation and control of domestic apparatus repair work, installation contracting and consumer service. Corporate membership of the I.E.E. or equivalent qualifications will be an advantage.

Applications, giving the names of two referees, must reach A. M. Harker, M.A.(Cantab.), Brighton and Hove District Manager, SEEBoard, Electric House, Castle Square, Brighton 1, by November 23, 1953.

A. L. BURNELL,
Secretary.
(F 561)

SURREY COUNTY COUNCIL

County Architect's Department

APPLICATIONS are invited for the appointment of ELECTRICAL ENGINEERING ASSISTANT, Grade II, at a commencing salary of £495 p.a., rising by annual increments of £15 to a maximum of £540 p.a., plus London allowance of up to £30 p.a. according to age.

Applicants should be neat and accurate draughtsmen, with experience in the layout and design of electric lighting and power services in buildings, and should be in possession of the National Certificate in Electrical Engineering.

The appointment will be subject to the provisions of the Local Government Act, 1937, and the successful applicant will be required to pass a medical examination.

Applications, stating age, qualifications and experience and accompanied by copies of three recent testimonials, should be sent to the County Architect, Surrey County Council, County Hall, Kingston-upon-Thames, not later than November 21, 1953.

Canvassing, either directly or indirectly, will disqualify a candidate from consideration.

W. W. RUFF,
Clerk of the Council.
County Hall,
Kingston-upon-Thames. (F 564)

THE WAITEMATA ELECTRIC POWER BOARD

New Zealand

ASSISTANT ELECTRICAL ENGINEER

APPLICATIONS are invited for the above appointment; candidates should hold a degree in engineering from an approved university, or should be Corporate or Graduate Members of the Institution of Electrical Engineers, and have had considerable experience in the design, installation, and operation of distribution and transmission systems up to 33,000 V, including overhead, underground and sub-station equipments.

The salary will be at a commencing rate of £1,000 per annum. Candidates should be between the ages of 30 and 40 years.

Further particulars and application forms may be obtained from the undersigned.

PREECE, CARDEW & RIDER,
8, 10 and 12 Queen Anne's Gate,
London, S.W.1. (F 601)

SOUTHERN ELECTRICITY BOARD

DRAUGHTSMAN (CIVIL ENGINEERING)

NO. 2 (NEWBURY) Sub-Area Office. Salary N.J.B. Schedule "D," Grade 6, £433 to £567 per annum. N.J.B. conditions of service.

Applicants should be capable of preparing drawings and making calculations, and have knowledge of building construction, steelwork and reinforced concrete structures.

The successful candidate will be required to contribute to the B.E.A. and Area Boards' Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Road, Newbury, Berkshire, and returned to him in envelopes, suitably endorsed, not later than November 23, 1953. (F 562)

BRITISH ELECTRICITY AUTHORITY

London Division

APPLICATIONS are invited for the following superannuable posts. Salary, including London Allowance, and conditions of service in accordance with N.J.B. Agreement, Schedule "A."

FIRST ASSISTANT CHEMIST
Taylors Lane Generating Station.

Candidates must have experience in a laboratory of a modern high-pressure station and be fully conversant with the testing and analysis of fuels, oils and water. Salary: Class "F," Grade 9, £637 7s. p.a.

ASSISTANT SHIFT CHARGE ENGINEER
Islington Generating Station.

Sound engineering and technical training with practical experience in the operation of power station plant. Qualifications entitling to graduate membership of the I.E.E. or I.Mech.E. an advantage. Salary: Class "D," Grade 9, £589 1s. p.a.

Application may be made on forms obtainable from Divisional Secretary, B.E.A., London Division, Generation House, Great Portland Street, W.1, and be received within 14 days of this advertisement. (F 586)

SOUTHERN ELECTRICITY BOARD

APPLICATIONS are invited for the following post: MANAGER OF THE ISLE OF WIGHT DISTRICT in No. 3 (Portsmouth) Sub-Area.
(Second advertisement.)

The provisional salary for this appointment will be £1,325 p.a., and the ultimate salary and conditions of service will be in accordance with such terms as may be laid down from time to time by the appropriate negotiating body.

Candidates for this post should be Chartered Electrical Engineers and possess a competent knowledge of commercial practice. They should have experience in the management of an Electricity Supply Undertaking.

The successful candidate will, if eligible be required to contribute to the B.E.A. and Area Boards' superannuation scheme.

Candidates who have already made application for the post may apply by letter referring to their previous application.

All other persons should submit applications on the standard form obtainable from the Secretary, Southern Electricity House, Littlewick Green, Maidenhead, which should be returned to him not later than November 27, 1953. (F 583)

BRITISH ELECTRICITY AUTHORITY

Merseyside and North Wales Division

REQUIRED, (a) SECOND ASSISTANT STATION CHEMIST. Salary £573/£593 per annum. N.J.B., Class "G," Grade 11.

(b) JUNIOR ENGINEER (LABORATORY). Salary, £402/£491 per annum. N.J.B., Class "G," Grade 16/14. Both appointments for the Percival Lane Power Station, Runcorn.

Applicants for (a) should preferably hold a University Degree or A.R.I.C. but consideration will be given to those holding the Higher National Certificate and studying for A.R.I.C. or equivalent qualification. A thorough knowledge of the chemical services required in a modern power station is essential. Applicants for (b) should have a sound practical training in laboratory work in particular analysis of oil, water and coal. Possession of the Higher National Certificate or equivalent qualifications would be an advantage.

Both appointments are superannuable and subject to medical examination. Forms of application from the Divisional Secretary, Beaconsfield Road, Woolton, Liverpool. Closing date, November 25, 1953. (F 605)

BRITISH ELECTRICITY AUTHORITY

South Wales Division

Vacancy No. 91/53.

APPLICATIONS invited for superannuable N.J.B. appointment of GENERAL ASSISTANT ENGINEER (Chemist), Generation (Operation) Department, Divisional Headquarters. The successful applicant will be employed at the Divisional Laboratory situated at Upper Boat Power Station, near Pontypridd. Salary AX/CX Grade 8, £501-£675 p.a.

H.N.C. in Chemistry required and candidates studying in addition for A.R.I.C. or University Degree particularly acceptable; experience in chemical analysis, fuel technology and corrosion problems advantageous.

Application forms obtainable from Divisional Secretary, South Wales Division, British Electricity Authority, Twyn-y-Iedwen Road, Gabalfa, Cardiff, should be returned by November 30, 1953.
November 5, 1953. (F 559)

BRITISH ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following post:
JUNIOR ENGINEER,
Norwich Generating Station.

Salary Class "F," Grade 15, £402—Grade 14, £466 per annum.

The duties of the successful applicant will include assisting in the Control Room on Shift and other operation and investigation duties. Preference will be given to applicants who have had previous experience in a Generating Station and who have reached the standard of the Ordinary National Certificate in Electrical Engineering or its equivalent.

Applications, stating age, qualifications and experience, should be sent to the Divisional Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, by November 21, 1953.

W. N. C. CLINCH,
Controller.
(F 558)

BRITISH ELECTRICITY AUTHORITY

North Western Division

VACANCY No. 205/53. ASSISTANT MAINTENANCE ENGINEER (Mechanical), Stuart Street Generating Station, Manchester 11. Salary £717/£748 (H. 8). Persons who have already submitted applications need not reapply. Closing date, November 21.

Vacancy No. 255/53. STATION SHIFT CONTROL ENGINEER, Agecroft H.P. Generating Station, near Manchester. Salary £608/£630 (G.10). Closing date, November 18.

Vacancy No. 256/53. SHIFT CHARGE ENGINEER, Burnley Generating Station. Salary £599/£622 (C.7). Closing date, November 21.

Vacancy No. 258/53. ASSISTANT SHIFT CHARGE ENGINEER, Stuart Street Generating Station, Manchester 11. Salary £680/£706 (H.9). Closing date, November 21.

Apply, quoting vacancy number to Establishments Officer, British Electricity House, 825 Wilmslow Road, Manchester 20. (F 566)

BRITISH ELECTRICITY AUTHORITY

South West Scotland Division

ASSISTANT MAINTENANCE ENGINEERS (Electrical) Clyde's Mill, Kilmarnock and Yoker Generating Stations

APPLICATIONS are again invited for the positions of Assistant Maintenance Engineers (Electrical) at Clyde's Mill, Kilmarnock and Yoker Generating Stations.

Applicants should have received a good technical education and have extensive experience of electrical equipment and maintenance in Generating Stations. The salary will be in accordance with Grade 8 of the National Joint Board Agreement, Class J, in the case of Clyde's Mill, and Class F in the case of Kilmarnock and Yoker Generating Stations.

Applications on Form AE.6, which may be obtained from Divisional Headquarters or any Divisional Office of the Authority, should be forwarded to 168 Broomhill Drive, Glasgow, W.1, before November 28, 1953.

A. CHRISTIANSON,
Divisional Secretary.
(F 562)

BRITISH ELECTRICITY AUTHORITY

North Western Division

VACANCY NO. 263/53—THIRD ASSISTANT ENGINEER (Civil) at Generation (Construction) Department, Agecroft, nr. Manchester. Commencing salary in range £649 to £790. Experience required: Design of reinforced concrete structures, foundations for plant, building structures, drainage and sanitation schemes, including all necessary calculations. Knowledge of estimating, preparation of bills of quantities, site measurement, etc., an advantage.

Applications to Establishments Officer, British Electricity House, 825 Wilmslow Road, Manchester 20, before November 21. (F 545)

BRITISH ELECTRICITY AUTHORITY

Midlands Division

GENERAL ASSISTANT ENGINEER is required in the Telecommunications Section of the Technical Department. N.J.B. service conditions, superannuable appointment. Salary within Schedule "C" Grade H, commencing in range £501 to £639, ultimately rising to £694 per annum.

Experience in the manufacture, design, commissioning and maintenance of various types of supervisory apparatus and communication equipment as applied to power undertakings required. Suitable technical qualifications an advantage.

Apply on Form AE8, quoting vacancy 546MD, to the Establishments Officer, 53 Wake Green Road, Moseley, Birmingham 13, by November 28, 1953. (F 580)

BRITISH ELECTRICITY AUTHORITY

Southern Division

APPLICATIONS are invited for a position as:
PROGRESS ENGINEER
Marchwood Site, Generation Construction Department.

The work will consist of checking and recording the progress of plant erection and the forwarding of contractors' materials to site. Applicants should preferably have had a general engineering shop and drawing office training, and should be studying for a recognised technical qualification (mechanical and/or electrical). Site or shipyard experience covering the erection of boilers and turbines, pumps and switchgear, etc., will be an advantage.

Salary N.J.B. "AX/CX," Grade 8, £501 to £675.

Special application forms, obtainable from P. D. A. Oliver, Divisional Secretary, 111 High Street, Portsmouth, must be returned by November 25, 1953. (F 584)

BRITISH ELECTRICITY AUTHORITY

South Western Division

SECOND ASSISTANT STATION CHEMIST required for Plymouth "A" and "B" Generating Stations.

Superannuation Scheme. Salary, N.J.B., Class "H," Grade 11, £607-£628.

Applicants should have had practical experience in the analysis of coal, water, oil, etc., for generating stations. Preference given to candidates possessing H.N.C. in chemistry or equivalent. Successful applicant will be required to carry out routine chemistry duties mainly of an analytical nature under the supervision of the Station Chemist.

Applications on Form A.E.6/ACT, obtainable from the Divisional Secretary, 26 Oakfield Road, Bristol, 8, should be completed and returned by November 30, 1953. (F 560)

BRITISH ELECTRICITY AUTHORITY

Merseyside and North Wales Division

REQUIRED, (a) SHIFT CHARGE ENGINEER at the Wallasey Power Station. Salary £633 to £643 per annum. N.J.B. Class "D," Grade 7. Applicants should preferably have qualifications leading to membership of an appropriate Institution and have a good technical education and be experienced in the shift operation of a modern generating station.

(b) ASSISTANT ENGINEER (OPERATION) at the Percival Lane Power Station. Salary £534 to £555 per annum. N.J.B. Class "G," Grade 12. Applicants should have experience in the control room of a modern generating station and the Higher National Certificate or equivalent qualification is desirable.

Superannuable and subject to medical examination. Forms of application from the Divisional Secretary, Bearonsfield Road, Woolton, Liverpool. Closing date: November 24, 1953. (F 604)

LONDON ELECTRICITY BOARD

ENGINEERING DRAUGHTSMEN

APPLICATIONS are invited for positions as Engineering Draughtsmen for electrical plant layout in the Drawing Office of the Chief Engineer's Department in central London.

Applicants should preferably have served an engineering apprenticeship and have had technical training. Experience in the layout of transforming plant, h.v. switchgear and cables would be an advantage.

The posts are graded under Schedule "D" of the N.J.B. agreement as Grade 6 (£458 to £595 7s. per annum, inclusive of London Allowance) and the commencing salaries will be dependent upon qualifications and experience.

Application forms obtainable from Establishments Officer, 46 New Broad St., E.C.2, to be returned completed by November 21, 1953. Please enclose addressed envelope and quote Ref. V/1580/T on envelope and all correspondence. (F 538)

ASSISTANT to WORKS MANAGER required by well-known domestic appliance manufacturers in the Home Counties employing 2,000. Applicants should be between the ages of 30 and 40, have good technical qualifications and general experience, and should have held a position of responsibility. Should be conversant with modern production methods and have knowledge of press and sheet metal work, welding, assembly and finishing processes. Replies, which will be dealt with in confidence, should give full details of education, positions held with salaries. Starting salary will be commensurate with age and experience and there are good prospects for the right man.—Box No. 3045, Electrical Times. (F 600)

BOX No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London W.C.2

BRITISH ELECTRICITY AUTHORITY, Merseyside and North Wales Division, require MAINTENANCE ENGINEER (Mechanical and Electrical) at the Bold Power Station, near St. Helens. Salary £831/£867 per annum. N.J.B., Class "G." Grade 5. Superannuable and subject to medical examination. Applicants should preferably be Associate Members of the Institution of Electrical or Mechanical Engineers or possess equivalent technical qualifications, and must have had wide experience in the maintenance of modern power station plant with experience in the control of labour.—Application forms from the Divisional Secretary, Beaconsfield Road, Woolton, Liverpool. Closing date, November 23, 1953. (F 568)

CABLE JOINTER required, must be fully skilled and capable of jointing to 11 kV. Good rates and subsistence paid to men willing to travel anywhere in England.—Apply in writing to: B. French, Ltd., Pike Mills, Green Street, Kidderminster, Worcs. (F 570)

CONTROL GEAR DESIGNERS required for manufacturers in South Midlands. Applicants should have knowledge of motor and machine characteristics and some control gear experience. Salary depending on qualifications. Staff pension scheme in operation.—Reply, giving full details of training and experience, to Chief Engineer, Igranic Electric Co., Ltd., Bedford. (F 569)

DESIGN DRAUGHTSMEN. Design Drawing Office of a leading manufacturer of electric cooking and heating equipment of all descriptions require Draughtsmen who have ability to create and are interested in design and development of new products. Unusual opportunity for a permanent position in factory situated in Home Counties. Modern conditions; pension scheme; five-day week, etc.—Replies, giving full details of experience, training, age and salary required, to Box No. 3025, Electrical Times. (F 528)

DRAUGHTSMAN. Applications are invited by Consulting Engineers in Westminster for a mechanical draughtsman for plant design and layout on hydro-electric projects. Applicants should have workshop training with a good technical background and some electrical experience is desirable. Salary will be based on previous experience and qualifications. Applications should be received not later than November 23 and should be addressed to Box No. 3047, Electrical Times. (F 606)

DRAUGHTSMAN required for preparing "As fitted" drawings, distribution schemes, etc. Good rates and conditions. Successful applicant would be based at Kidderminster but must be prepared to spend short periods away from home occasionally.—Apply in writing, to: B. French, Ltd., Pike Mills, Green Street, Kidderminster, Worcs. (F 571)

ELECTRICAL CONTRACTOR requires ESTIMATOR and SUPERVISOR for small contracts London area. Write, stating age, experience and salary required.—Box No. 3035, Electrical Times. (F 572)

ELECTRONIC ENGINEER required for turbine laboratory. Applicants should possess a degree in electrical engineering. Previous experience in physics, electrical engineering or instrument technology would be an advantage. Pension scheme.—Apply: Personnel Officer, Sir George Godfrey and Partners, Ltd., Hampton Road West, Hanworth, Middlesex. (F 607)

FERRANTI LTD. wish to make new appointments in their Power Transformer Design Office and invite applications from suitable candidates for positions as DESIGN ENGINEERS. A University degree is desirable but other alternative qualifications will be considered. Previous design experience in power engineering (not necessarily on transformers) would be an advantage. Applications are also invited from young graduates or holders of the Higher National Certificate with an interest and preferably some experience in design of transformers, or other electrical plant.

The appointments are to the permanent staff of an expanding design group and carry attractive salaries with excellent prospects of advancement. The positions are covered by the firm's Staff Pension Scheme.

Forms of application from Mr. R. J. Hebbert, Staff Manager, Ferranti Ltd., Hollinwood, Lancs. Please quote reference WLE. (F 548)

JOHNSON AND PHILLIPS, LTD., require a Senior Switchgear Designs DRAUGHTSMAN experienced in the design of l.v. breakers and switchgear up to 30 MVA. Only men having actual design and workshop experience and accustomed to working on own initiative with the minimum of supervision should apply. Vacancy offers good opening to the right man.—Applications, giving full particulars of training and experience together with salary required, to Employment and Welfare Manager, Johnson and Phillips, Ltd., Victoria Works, Charlton, London, S.E.7. (F 429)

MARRYAT AND SCOTT, LTD., of Wellington Works, Hounslow, Middlesex, require LIFT DRAUGHTSMEN for layout work and design. Bonus and superannuation.—Apply in writing with full details of past experience. (F 588)

Engagement of persons must be made through a Local Labour Office or Scheduled Employment Agency, if the applicant is a man aged 18-64, or a woman aged 18-59; unless the person concerned is excepted or the employment is in a managerial or professional capacity, or is otherwise excepted from the provisions of the Notification of Vacancies Order, 1952.

PIRELLI-GENERAL CABLE WORKS LTD. require TRANSMISSION LINE SURVEYORS and ASSISTANT ENGINEERS with experience on steel towers and wood pole lines.—Write giving particulars of experience and salary expected to Overhead Lines Department, Eastleigh, Hants. (F 589)

SALESMAN with knowledge London wholesalers, housing authorities, etc., required by manufacturer domestic plugs and sockets, control units, etc.—Box No. 3049, Electrical Times. (F 608)

SALES REPRESENTATIVE required by Electric Cable-maker (C.M.A.). Preference given to applicants who have established connections in Chester and North Wales area. State age, experience and salary required. —Box No. 3037, Electrical Times. (F 573)

SWITCHGEAR ESTIMATOR for South Africa. Johnson and Phillips, Ltd., require a Switchgear Estimator for their South African factory. Duties include handling inquiries and preparation of estimates for locally built and/or imported switchgear and components. Young man required, preferably single. Applicants should possess sound practical training supported by good technical education. Good prospects and salary for the right man.—Applications, giving full particulars of age, training and experience to Employment Manager, Johnson and Phillips, Ltd., Charlton, London S.E.7. (F 455)

TECHNICAL ENGINEER required by manufacturers of paper, rubber and plastic insulated cables (North West England). Applicants must be Corporate Members of the Institution of Electrical Engineers, or possess a degree in engineering, and must be experienced in cable design and testing.—Box No. 3041, Electrical Times. (F 590)

TECHNICAL SALES ENGINEER with knowledge control circuits and contactor gear generally required by control gear manufacturers, London area. Previous sales experience essential.—Box No. 3051, Electrical Times. (F 609)

THE CENTRAL LONDON and Midland Branches of an established company are opening new departments, and require SENIOR ELECTRONIC or ELECTRO-MECHANICAL DRAUGHTSMEN, preferably with experience of IDP.13 RCS.1000. Draughtsmen applicants not possessing experience of these standards will be considered for training in these specialised vacancies. —Box No. 3029, Electrical Times. (F 549)

THE ENGLISH ELECTRIC CO., LTD., at Liverpool, offer opportunities for young, fully trained and qualified ENGINEERS to work on electric domestic appliance design and development. There are interesting vacancies open in this highly competitive and progressive field for men with initiative and new ideas—experience of domestic appliances, whilst being an advantage, is by no means essential. Assistance will be given in housing the successful candidates.—Apply in confidence to Dept. C.P.S., 336-7 Strand, W.C.2, quoting Ref. 4520. (F 519)

THE NATIONAL BOILER AND GENERAL INSURANCE CO., LTD., St. Mary's Parsonage, Manchester 3, require ENGINEERS for appointment as Inspecting Engineers of Lifts and Cranes. First-class M.o.T. Certificate of Competency, and/or Higher National Certificate (Mechanical or Electrical), full apprenticeship and practical experience necessary. Apply in own handwriting giving age (limits 26 to 33), training and experience, academic qualifications and copies of testimonials. Salary £540 to £785 (progressive). Non-contributory pension scheme. (F 591)

WELL-KNOWN Electrical Manufacturing Company has vacancies for SALES ENGINEERS for industrial motors in various parts of the country. Successful applicants must be trained electrical engineers with O.N.C. as a minimum qualification and with previous sales experience in the areas covered. They will work from the company's existing branch offices. Remuneration by salary and expenses. Non-contributory pension scheme.—Apply Box No. 3031, Electrical Times. (F 550)

APPOINTMENTS WANTED

ELECTRICIAN, armature winder wishes employment, age 24, single.—Box No. 3043, Electrical Times. (F 595)

ENGINEER (single, 45) seeks a vacancy home or abroad. Long experience general electrical contracting; 20 years specialised experience manufacturing lead-acid storage batteries, including manipulation raw oxide of lead and grid casting.—Box No. 3093, Electrical Times. (F 552)

WORK WANTED

A.C. and d.c. MOTOR REWINDS and REPAIRS. Prompt service fully guaranteed. Edgware 5566 (4 lines).—Service Electric Co., Ltd., Stanmore, Middx. (F 13)

ARMATURE REWINDING service to the trade. Vacuums, Drills, Grinders, Hood Dryers, Dental Motors. Vacuum cleaner and drill armatures replaced from stock 24-hour service. Every job guaranteed. All vacuum cleaner parts, hoses, etc., in stock for any make. Apex washer agitator shafts stocked.—Regam Electric Cleaner Service, 95 Park Lane, Leeds 1. (F 22)

FISHER FOUNDRIES, LTD., Greet, Birmingham, have immediate capacity for machine moulded PRECISION CASTINGS in gunmetal and grey iron, ¼ to 30 lb. All castings shot blasted.—Telephone: Birmingham, Victoria 0197. (F 16)

WORK WANTED. Capacity available for all types of COIL WINDING.—Box No. 2425, Electrical Times. (F 17)

WANTED

A.C.-D.C. MOTORS, STARTERS, complete change-over installations, etc.—A.A. Electrical Co., Ltd., 67 Rothschild Road, Chiswick Park, W.4. Tel.: Chiswick 5105. (F 8)

WANTED, D.C. and A.C. ball-bearing MOTORS, MOTOR GENERATOR SETS, DYNAMOS and ALTERNATORS.—Full details to Britannia Manufacturing Co., Ltd., 22-26 Britannia Walk, London N.1. (F 4)

WANTED, for prompt cash, ferrous and non-ferrous SCRAP; also plant for dismantling. Buyers of secondhand machinery and plant for re-use.—W. and H. Cooper, Ltd., 176 Brady Street, Bethnal Green, E.1. (F 1)

WANTED. Large quantity of 4-in. outside diameter TUBES from the dismantling of old Babcock water-tube boilers. Best prices paid. Prepared to purchase Babcock and Wilcox water-tube boilers for dismantling.—Apply, giving full details, to Midland Iron and Hardware Co., Cradley Heath, Staffs. (F 2)

WANTED. ROTARY CONVERTERS, any size.—Universal, 221 City Road, London E.C.1. (F 6)

AGENCIES

AGENTS already calling on large stores, electricity boards, first class hardware merchants and furnishers throughout the United Kingdom, invited to handle top-grade domestic appliance. Entirely new, no competition. Exclusive territories now available throughout the British Isles.—Box No. 3039, Electrical Times. (F 574)

M.A.A.—THE BADGE OF A GOOD MANUFACTURERS' AGENT. Manufacturers requiring reputable Agents are invited to communicate with the Secretary, The Manufacturers' Agents Association of Great Britain and Ireland (Inc.), Rosebery House, 9 Breams Buildings, London E.C.4. Membership available to established Agents only. Particulars supplied. (F 19)

FOR SALE

CABLES & WIRE

MANGANIN RESISTANCE WIRE. Various gauges usually stock.—Saxonia Electrical Wire Co., Ltd., Roan Works, Greenwich, S.E.10. (F 421)

TINNED STEEL ARMATURE BINDING WIRE. All sizes from 14 s.w.g. to 30 s.w.g. supplied in coil or on reels.—Frederick Smith and Co., Wire Manufacturers, Ltd., Caledonia Works, Halifax. (F 102)

175 YD 0·10 4-core P.I.L.C.J.S. at 37/6 per yd or £300 including drum.—Box No. 3005, Electrical Times. (F 442)

DOMESTIC APPLIANCES

FOR SALE 5 TUBULAR HEATERS, 10 ft. each. Good as new, £15.—Phone KIN 9644. (F 592)

TWO 2½ kW UNIT HEATERS at £10 each. One 5 kW UNIT HEATER at £20. Made by G.E.C., almost as new. Prices at our works.—Apply, Collier and Son, 2 Ashburnham Road, Northampton. (F 575)

130 HIRAE HEATING UNITS, 1,000 Watts. 95 Thermostats 44° to 76°. All items unused.—Offers to Assistant Secretary, B.C.U.R.A., Randalls Road, Leatherhead. (F 593)

GENERATING PLANT

DIESEL GENERATOR SET, comprising Ruston engine, VCBA Mark 5, 600 r.p.m., and Brush 110 kW ALTERNATOR, with all equipment, for sale. Unused and not installed.—Reasonable offers to Box No. 3027, Electrical Times. (F 543)

GENERATING SET. Meadows Petrol Electric 9 kVA, 230 V a.c. Automatic. As new, £120.—H. S. Cawsey, Station Approach, West Byfleet, Surrey. (F 551)

540-kW 130/175 V d.c. GENERATOR by Bruce Peebles. 4,125/3,075 amps. Shunt interpole, open type frames, split carcase. Suitable for direct coupling. Speed 428 r.p.m.

500-kW 480/520/550 V d.c. GENERATOR by Bruce Peebles, 1,040/910 amps. Compound interpole, 3 wire, fitted 4 slip-rings. Speed 750 r.p.m.

350-kW 230 V d.c. GENERATOR by G.E.C. Six pole, compound interpole. Suitable direct coupling only. Speed 300 r.p.m.

250-kW GENERATOR by Met.-Vick. for 500/440 V d.c., 2 wire, 500 amps. Speed 375 r.p.m. Open type compound wound.

200-kW GENERATOR by Mavour and Coulson, for 500 V d.c., 400 amps. Speed 380 r.p.m. Open type, 6 pole, compound interpolar wound. Single pedestal R.O.B.

200-kW GENERATOR by E.C.C., for 200 V d.c., speed 1,000 r.p.m. Open type, single pedestal bearing. Compound wound, fitted interpoles.

George Cohen, Sons and Co., Ltd., Wood Lane, London, W.12. Tel.: Shepherds Bush 2070 and Stanningley, nr. Leeds. Tel.: Pudsey 2241. (F 597)

LIGHTING EQUIPMENT

A NUMBER of WROUGHT IRON FITTINGS and WALL BRACKETS for sale.—Can be seen at Bernard Sunley and Sons, Ltd., 77 South Lambeth Road, S.W.8. Nearest offer. (F 576)

PURLEY CHOKES AND BALLASTS. Our 80-W tapped h.p.f. ballast with starter switchgear-holder incorporated is proving itself the most popular unit. Suitable for most fittings 57s. 6d. each subject.—F. W. Blanshard, Ltd. (Dept. E.T.), Purley, Surrey. Uplands 4818-9. (F 14)

METERS

A.C.—D.C. QUARTERLY and SLOT METERS.—Brent Electrical Co., 6 Holmdale Gardens, London N.W.4. (F 5)

DON'T worry about your electricity bills. Fit 1/- slot electric meters for hotels, bed-sitters, etc. Prices from 50/-.—Selectrics, Department E.T., Castle Circus House, Torquay. Tel. 7218. Trade inquiries invited. Trade discount. (F 468)

HOUSE-SERVICE METERS, a.c. or d.c., quarterly or prepayment.—Universal Electrical, 221 City Road, London E.C.1. (F 10)

SWITCHGEAR

MERCURY SWITCHES are made by Hall, Drysdale and Co., Ltd., of 58 Commerce Road, Wood Green, London N.22. Tel.: BOW. 7221. (F 11)

TIME SWITCHES for sale. Reconditioned or new. 1 months' guarantee. Immediate delivery. Lists, from: J. W. Hughes, 3 St. Thomas' Street, London Bridge S.E.1. (Tel.: HOP. 2750). (F 487)

MOTORS & STARTERS

A. A. ELECTRICAL CO. for A.C.-D.C. MOTORS SWITCHGEAR, EXHAUST FANS, HOISTS, REDUCTION GEARS, new or reconditioned units.—Chiswick 5105, Chiswick 5605, 67 Rothschild Road, W.4. (F 7)

A.C. and D.C. MOTORS, all sizes, large stocks. Fully guaranteed.—Milo Engineering Works, Ltd., Milo Road, East Dulwich, S.E.22 (Forest Hill 2278-9). (F 3)

A.C. and D.C. MOTORS, GENERATORS from stock.—Service Electric Co., Ltd., Honeypot Lane, Stanmore, Middx. Edgware 5566-9. (F 9)

FLAMEPROOF MOTORS, M.G. SETS, D.C. MOTORS, GEARED MOTORS, A.C. MOTORS, TRANSFORMERS, CONTROL GEAR. SPECIALS. FLANGE MOTORS.

ELECTROPOWER COMPANY LIMITED

Kingsbury Works, Kingsbury Road, London, N.W.9.
Tel.: COLindale 4621/3.
Grams: Lektropowa, Hyde, London. (F 12p)

UNCLASSIFIED

BOROUGH OF HARROGATE

THE HARROGATE CORPORATION are prepared to receive offers for the following second-hand electrical equipment:
3,700 ft. of heating tubes.
100 Satchwell Bi.Metal Thermostats
100 15 amp surface switches.
The materials can be inspected by appointment. Offers are to be received not later than 10 a.m. on Monday, November 30, 1953.

C. E. FELLOWS,
Borough Engineer.

Municipal Offices,
Harrogate.
October 29, 1953. (F 578)

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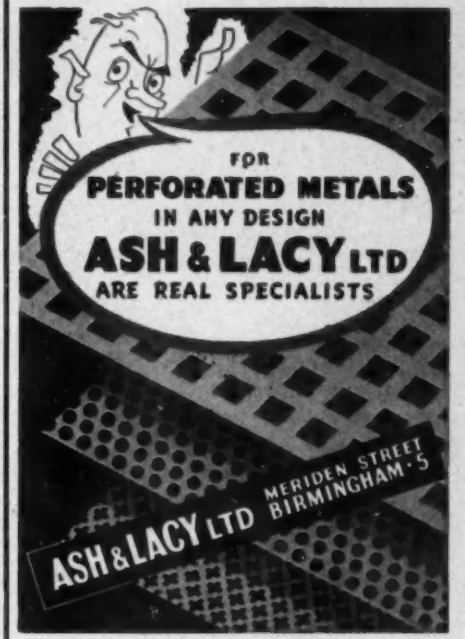

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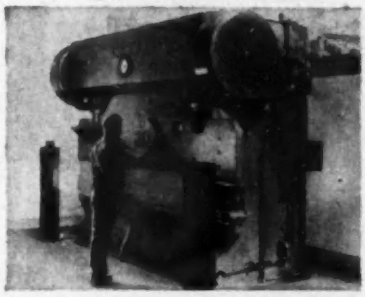

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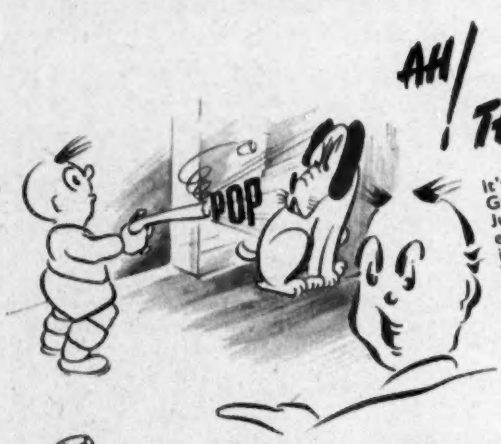

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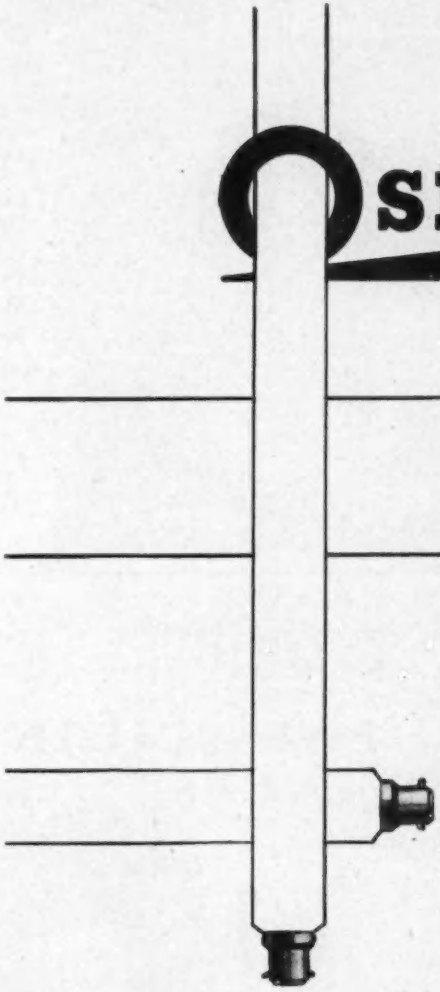

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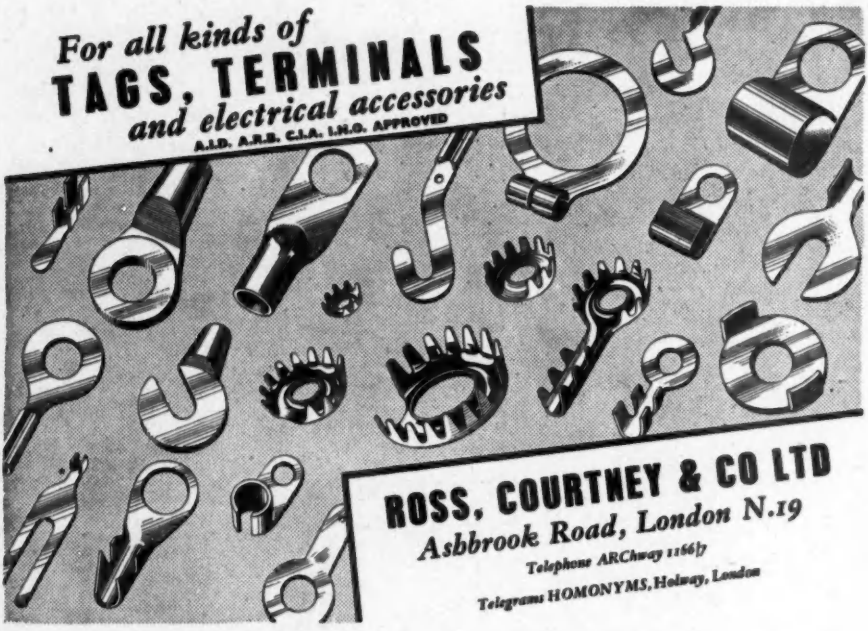

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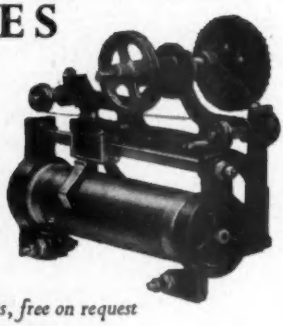

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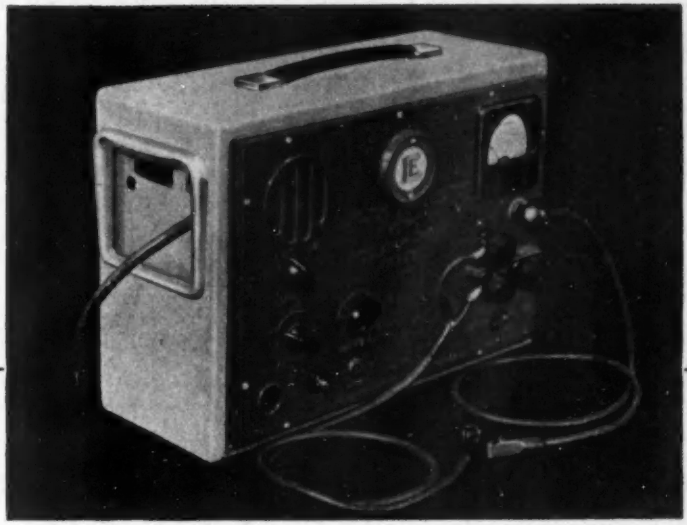

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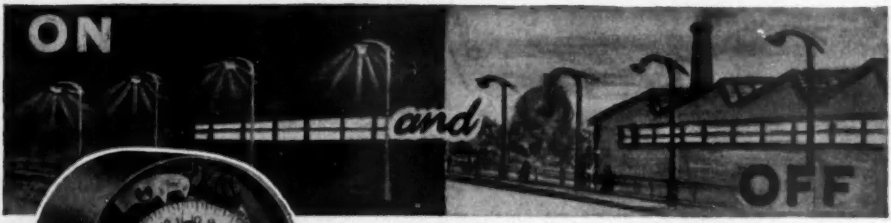

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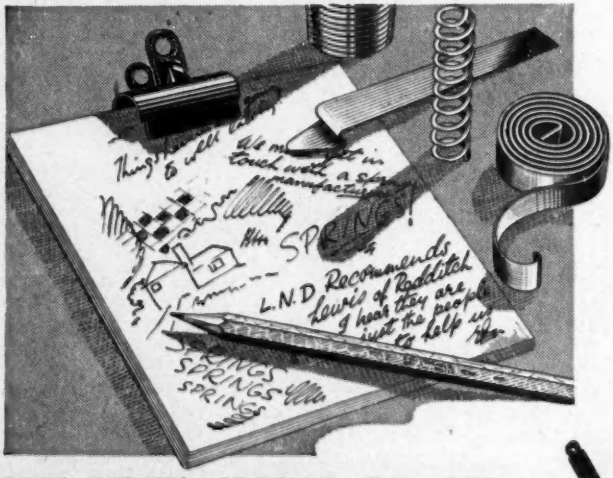

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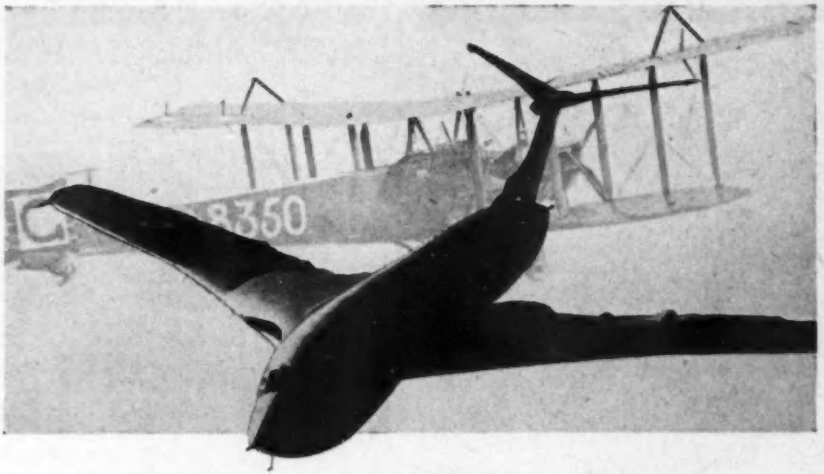

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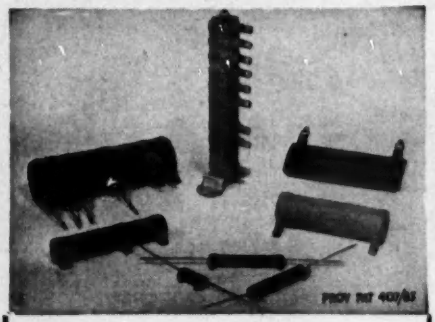

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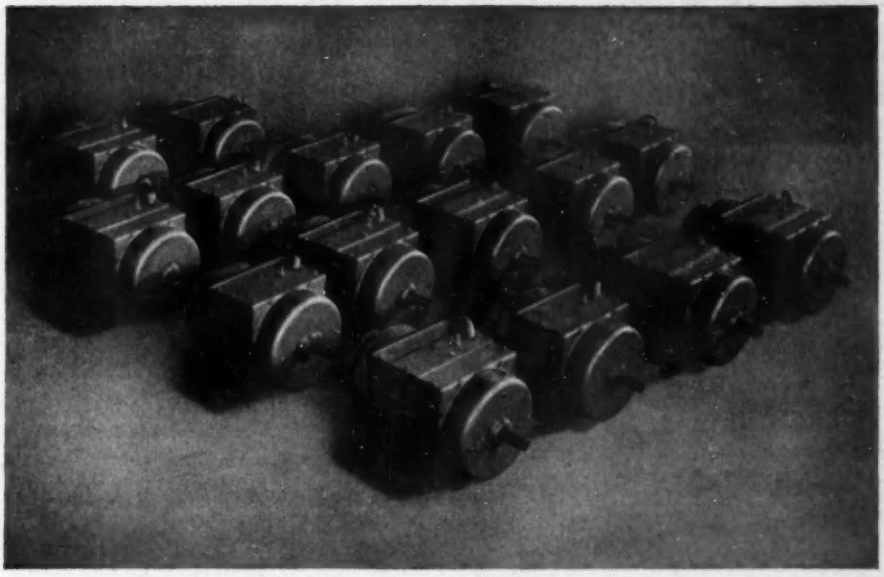

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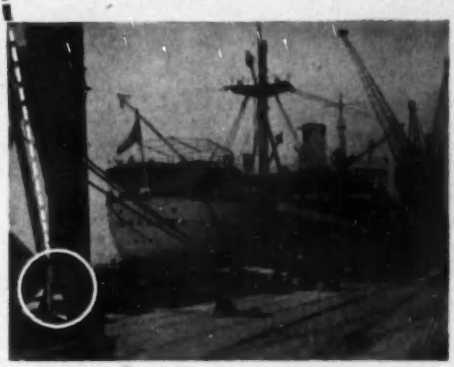

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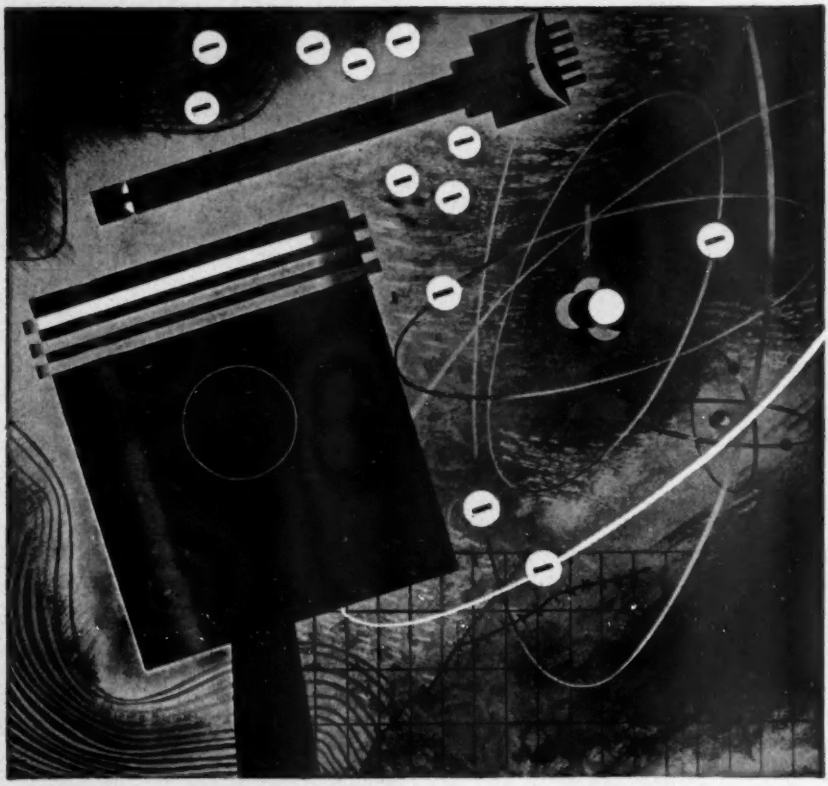

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Printed in England for the Proprietors, THE ELECTRICAL TIMES, LTD., by SUN PRINTERS, LTD., London and Watford, Herts. and published at Sardinia House, Sardinia Street, London W.C.2. November 12, 1953

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